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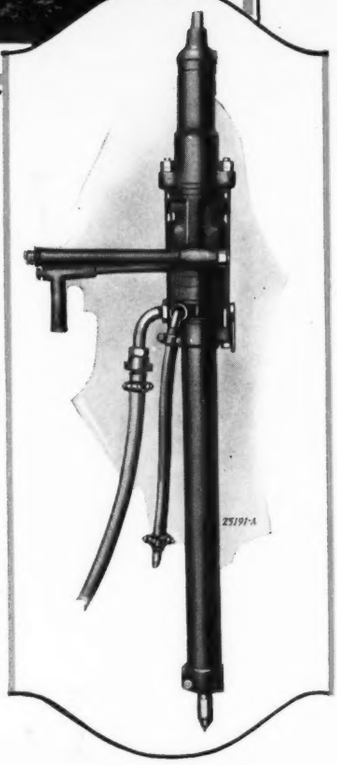

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ENGINEERING AND
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Europe Is Perturbed at Outlook for Tin

WIDE INTEREST in European and particularly in British metal circles has been aroused by the comprehensive review of the world tin situation published recently in *Engineering and Mining Journal* under the caption "Is 45-Cent Tin Likely?" An advertisement occupying a full column in the *Wall Street Journal* of May 24 reproduced remarks made to the shareholders of the Anglo-Oriental Mining Corporation by the chairman, Mr. John Howeson. These comments, generally regarded on both sides of the Atlantic as being prompted by the article referred to, apparently are expected to have a double object: First, to allay to some extent any possible apprehension on the part of British shareholders in tin-mining companies and to facilitate the further financing of tin projects in Malaya and Nigeria, for which he says "much more money is needed." Second, as evidenced by the publication as an advertisement in the American press, to repeat to the American consumer of tin the old story anent "a constant growth in the world's demand for the metal" and the "limitation of supply." These, he says, are the two cardinal facts upon which the soundness of the industry is founded.

One of London's prominent metal "services," commenting on the article, regards it as "practically certain that tin will dip below 45 cents more than once before the end of 1929," but is equally positive in the view that the *average* for the remainder of 1928 and all of 1929 will be above 45 cents.

The principal point made in the original article was that the great profits in tin mining (running as high as, or even higher than, 50 per cent per annum on invested capital in recent years) had so stimulated the launching of new companies and the expansion of production by other companies, by the installation of new and better equipment, that a large surplus production, with declining prices, is possible, if not probable, during the remainder of 1928 and in 1929. In this connection the following figures in long tons, compiled by *The Mining Journal*, of London, showing April tin production, are significant:

TIN PRODUCTION

	1928	1927	
Federated Malay States.....	4,772	4,097	+ 675
Banka	1,168	730	+ 438
N.E.I. to Straits.....	1,285	1,089	+ 196
Siam, Burma, &c.	1,006	790	+ 216
Bolivia	3,351	1,636	+1,715
Nigeria	651	787	— 136
Total.....	12,233	9,129	+3,104

The excess for the first quarter of 1928, compared with 1927, was 3,507 tons, making a total increase of 6,611 tons for the first four months of the year. "It is," observes our London contemporary, "obviously quite absurd to talk, as seems to be the fashion in the tin market just now, of the high rate of production dying away."

Engineering and Mining Journal has neither purpose nor desire to bear the tin market. The article "Is 45-Cent Tin Likely?" endeavored to present all the facts as they appeared to a disinterested observer. No one was warned or advised in that article; but we venture to suggest to the producers of tin that they study carefully the recent history of the markets for lead, zinc, and copper. They should note what happened to the markets for lead and zinc following a period of soaring prices and much talk of famine; and they should note how the copper industry has operated at 80 per cent of productive capacity for several years to protect its market. Tin may be immune from the influence of economic law; but such a conclusion forms a risky foundation on which to base a policy for the tin-mining industry.

Notable Progress Is Reported in Steam-Generation Practice

AMAZING DEVELOPMENTS of an electrical age have obscured the notable achievements in steam generation reported during the last decade. Furnace efficiencies have increased remarkably, a reflection of which is seen in the temporary lessened demand for coal.

The effect of fuel economy on the consumption of coal per unit of performance is indicated in various factors: in 1919, steam-electric power plants burned 3.2 pounds of coal per kilowatt-hour produced; in 1925 the amount was only 2.1 pounds, and more recently it has been reduced to 1.80 pounds. In the same five-year period, steam railroads showed a decrease of 18 per cent in coal consumed per 1,000 ton-miles of freight service and of 13 per cent per car-mile in passenger service. Likewise, the steel industry succeeded in decreasing by 9 per cent the amount of coking coal required to make a ton of pig.

The reduction of more than 34 per cent in the amount of coal burned per kilowatt-hour produced by public-utility companies in the United States has been brought about by radical changes and refinements in power-plant practice. Some of these are startling. The substitution of water tubes for the refractory walls of the combustion chamber is perhaps the most revolutionary.

Foremost in its contribution to increased efficiency in steam generation has been the use of powdered fuel. "There is nothing to take the place of pulverized coal," says Mr. George T. Ladd in a paper on recent developments in steam generation, printed in the issues of *E. & M. J.* of May 19 and 26. With lump fuel, he maintains, it would have been difficult, if not impossible, to secure the large steam outputs obtained today. He cites how two 2,650-horsepower boilers, in Detroit, equipped with water-wall furnaces and burning powdered coal, are now delivering

continuously 500,000 pounds of steam per hour, and one of them has produced, on occasion, over 600,000 pounds.

Among the refinements in practice that have played their part may be mentioned water conditioning, air preheating, and the recovery of waste heat. Dry quenching has improved the quality of coke and, at the same time, has permitted conservation of heat. Low-temperature distillation of coal promises important new economies for the future.

Indeed, the mining company that is using a steam-electric plant instead of buying power will do well to study it to see if, perchance, some advantage may not be gained by modernization. In the manufacturers of combustion engineering equipment they will find a ready source of competent advice.

Annual Company Reports and Mine Accounting Systems Lack Uniformity

CO-OPERATION among American operators in the exchange and publication of information on technical methods and costs of operation is an outstanding characteristic of the industry, the widespread benefit accruing from which is fully appreciated. Technical improvements at one plant are promptly transmitted throughout the field, and a condition approaching standardization exists in many divisions of practice.

With technical co-operation an established condition in the industry, it is strange that accounting methods, particularly those adopted in the presentation of information in company reports, should be so widely divergent. A stockholder who attempts to compare the results of operations of any two mining companies by a study of their respective reports is likely to experience a feeling of dismay. Variations are frequently superficial, but often they are truly fundamental. One company includes "operating income" with "investment revenue," under the heading "gross income"; another reports base-metal production in dollars and cents; and a third may show only income from metal sold, making the actual production ascertainable only by a variety of mathematical calculations. The number of possible alternative methods of expressing the same thing seems to be infinite. Frequently the annual profit-and-loss statement is punctured with constant use of the abbreviation "etc.,"—"depreciation, etc.," "income from metal sold, etc.," "federal and local taxes, etc."—the possible interpretations of which are likewise unlimited. If variety is the spice of life, the peruser of mining company reports surely leads a condimentary existence.

Both the leading technical societies have committees to study the accounting systems of American mining companies; and the benefit accruing to the industry would be considerable if their efforts and recommendations promoted standardization in method. The refusal to reveal full financial information in company reports of foreign companies, among which industrial co-operation is less general, may be understood; but American companies might well take a different attitude. An inherent dislike of change may be the cause of the present status of affairs, but it is not too much to hope that some uniformity in accounting systems comparable with those established by the technical divisions of the industry may eventually be recognized as highly desirable in the interests of all concerned.

Air Movement in Deep Mines Offers Best Solution of Heat Problem

THE South African Institution of Engineers is to be congratulated on the scientific thoroughness with which it is investigating the problem of temperature reduction in deep mines. A paper by Dr. J. H. Dobson has received wide attention. In a recent issue of the *Journal* of the society, Messrs. M. O. Tillard and E. C. Ranson discuss the various methods of attack, comprising (1) circulation or movement of mine air; (2) the refrigeration of the air; (3) cooling the compressed air used; (4) cooling the mine water supply; (5) air drying underground by dehydrating agents, and (6) increasing the evaporative power of the air by modifying the existing working methods.

Refrigeration of the air, on the surface or underground, offers no practical solution of the problem, according to the conclusions. Cooling the compressed air used involves a power consumption that is prohibitive. Cooling the mine water, probably by spraying, invites complication and introduces a health hazard. The use of chemicals underground to dry the air is considered a futile task. In conclusion, it is considered that maximum benefit is best obtained by the "full exploitation of air movement," involving (1) a ventilating plant of adequate capacity; (2) the concentration of air in the bottom levels before splitting; and (3) efficient control of air flow throughout the mine.

The factor of temperature, in a manner, is relative, the effect depending on the difference between wet- and dry-bulb readings, which should be as far apart as possible. High humidity is undesirable, especially when dust is present. The unlimited use of water underground is not to be recommended. Ample ventilation and air movement appear to offer the most logical corrective of unfavorable atmospheric conditions.

Underground Communication Still an Unsolved Problem

WHENEVER an accident entombing a number of miners occurs, the problem of communicating with the men assumes pressing importance. Are they alive or dead? Where are they and what is the quickest way of reaching them? These and other questions are asked by employer, relatives and the press. Usually an answer is not forthcoming at once and often it is obtained too late. An investigation of the problem by the government has been under way for several years. The results to date can scarcely be considered a satisfactory solution.

Radio promised much a few years ago. Surely, it seemed, the earth's strata were sufficiently permeable to high-frequency waves to permit signaling over a distance limited to the workings of a mine. As a matter of fact, signals have been received underground from the surface, and in some instances it is likely that a considerable thickness of rock has been penetrated. In a recent bulletin of the U. S. Bureau of Mines, however, the authors, Messrs. L. S. Ilsley, H. B. Freeman, and D. H. Zellers, say that strong suspicion exists that the signals received in some cases have been carried through shafts and wiring and piping systems. But the principal obstacle to

the use of radio in mine rescue work, they say, is in the bulkiness of the apparatus. Makers of radio equipment should be able to overcome this difficulty, it would seem, unless the penetrability of the strata proves insufficient to permit the use of light equipment for transmitting and receiving.

Two methods of underground communication seem to promise usefulness, according to these investigators—the geophone or earth-vibration method, and the grounded-line or roof-rail conduction method of communication by telephones. They suggest a combination of these two systems as possibly more practicable than either one alone. In such a composite system the underground transmitter would be a sledge, or a rock, and the underground receiver a telephone receiver of the watch-case type, to be carried in the miner's first-aid kit. On the surface a telephone would serve as transmitter, and a geophone as receiver. Further development of the two systems, however, would be essential if they were to be efficiently combined.

Whatever be the solution sought—and ultimately found—it is certain that the apparatus which is intended for use underground by victims of an accident must be of the simplest sort and of such a kind that it may be readily carried by a miner at his regular work, or kept in or near the stope or heading where he and his fellows may be employed, to be moved with them when they are transferred to another working place. Thus the sledge is suggested as the transmitter. It is not practicable to depend on emergency equipment kept in one place in a mine or even in every station of a shaft, for this would afford no assistance to workmen isolated some distance from the *cache*.

Arc Welding Proves Successful in Building Construction

THE successful erection of a factory building by arc welding at the Philadelphia plant of the General Electric Company points the way to more economical construction in the mining field. A description of this achievement appeared in *Engineering News-Record* of May 17, 1928. In the design of the structure a working stress of 3,000 pounds per linear inch of bead (weld) was allowed, providing a factor of safety of 4. Much of the steel was shop-fabricated. Compared to a riveted structure there was a saving of 12 to 15 per cent in the weight of steel required. These are important advantages, especially the saving in weight. Most mine structures involve heavy freight and haulage charges, so that any considerable saving in weight would appreciably lower cost of construction. A saving in time for erection is also made.

Few large mining companies are without cutting and welding equipment of several kinds, and experienced welders are usually available in the shop crews. It is only a step in advance to use welded steel for building construction.

Although, obviously, all steel structures cannot be satisfactorily welded, most can be in part. Initiative in design is needed, and the borrowing of experience from the civil engineering field. The cost of timber and high transportation charges suggest the use of steel in place of timber in many instances. Careful designing and fabrication at large centers of supply will reduce to a minimum the need for extra shop equipment.

To the New Members of the Mining Profession

SOME WEEKS AGO Mr. J. O. Elton, manager for the International Smelting Company, was asked to speak at a dinner given by an undergraduate organization of students in the department of mining and metallurgy at the University of Utah. He accepted the invitation, and, when called upon to address the group, suggested that they all go to his offices, a few minutes' walk distant. "There," he said, "we will be more at home, and I can give you a talk—a real, straight-from-the-shoulder, home talk."

He did so, sketching in detail his personal experience, which included a complete mining and smelting record from underground laborer to mine superintendent, from laying rail at a smelting plant to acting as smelter manager. His talk was full of sound advice, substantiated, as presented, by references to his own career. Unquestionably, the group could little realize the privilege that was theirs, or the speaker gage the probable value to his listeners of such a revelation.

At the conclusion of his talk Mr. Elton distributed to the students a list of "Questions a Young Engineer Should Ask Himself From Time to Time When Considering His Job." These follow:

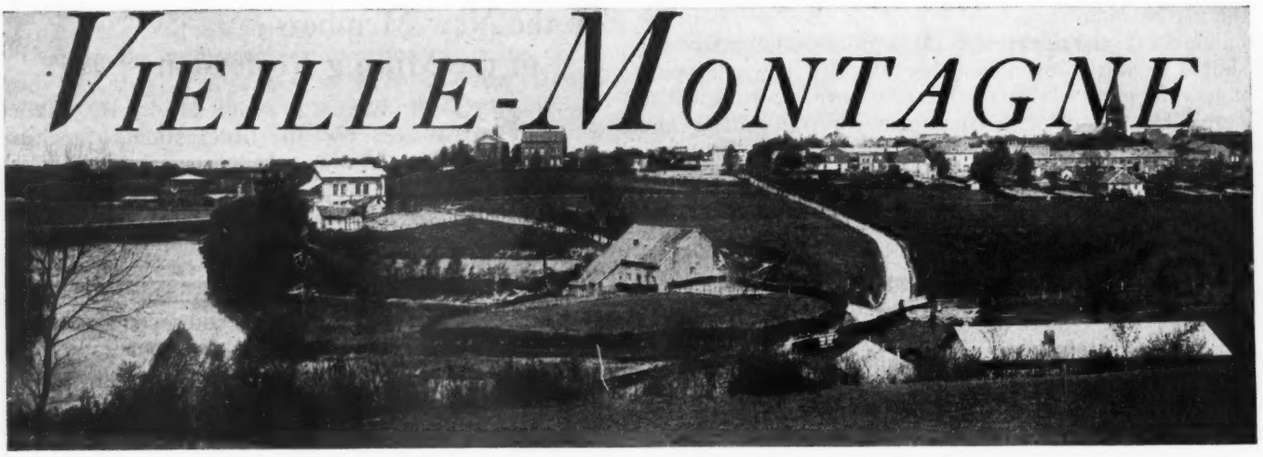
1. Am I getting enough money on which to live?
2. Can I retain my self-respect and do what I am called upon to do?
3. Am I making use of the technical information it took four years to gain in college?
4. Am I getting experience that will be helpful later?
5. Am I building up a worthwhile acquaintance?
6. Am I doing a class of work I like?
7. Do I believe that there is a real future in my work?
8. Am I working for a concern with which I am proud to be associated?
9. Do I feel that I am working with my boss instead of for him?
10. Does the policy of the company make me feel that if I put over my job I will get the recognition I deserve?
11. Am I in the right department?
12. Is it the policy of the company to develop its own executives?

If a majority of the above questions are answered in the affirmative, the following questions may be asked:

1. Am I doing my best to earn my pay?
2. Am I becoming more efficient as time goes on?
3. Am I trying to fit myself for the next higher job?
4. Am I helping the new beginner?
5. Am I fitting into the organization, being cheerful and congenial?
6. Am I doing my duty as a citizen as well as an employee?
7. Am I avoiding harmful associations?
8. Am I thrifty? That is, am I saving, if only a little bit?
9. Am I improving myself in my spare time?
10. Are my recreations healthful and harmless?
11. Do I believe in my future?
12. Am I worthy of the confidence of my employers?
13. Am I conducting myself so that my fellow employees are proud to have me for an associate?
14. Am I loyal to the hand that feeds me?
15. Am I a booster for my company?

This questionnaire of Mr. Elton's is reproduced in these columns for two reasons: first, that it may encourage other leaders of the mining industry to devote some of their time to the coming generation, and second, that it may serve as a guide to undergraduates in the mining schools of the country, many of whom in a few weeks will begin their life's work.

VIEILLE-MONTAGNE



School, church and casino buildings at Moresnet, Belgium

A Pioneer in

A STRIKING ASPECT OF THE CONTINENT'S GREATEST ZINC PRODUCER

as described by

LOUIS HIRSHLER

Consulting Engineer
S. A. de la Vieille-Montagne

IF YOU pick up the ninetieth annual report of Vieille-Montagne you will note at once that the company attaches great importance to welfare among its employees. You will see that out of a profit of a little less than 54,000,000 Belgian francs in 1926 it set aside the sum of 8,500,000 francs for bonuses and pensions. Of this, 1,500,000 francs was intended to supplement, where necessary to meet the increased cost of living, the bonuses already granted to retired workmen and foremen.

Vieille-Montagne is a company with traditions. To have traditions an organization as well as an individual must have a history stretching back an appreciable distance into the past. Vieille-Montagne had its start in its present corporate form in Belgium 90 years ago. It was in 1837 that the zinc company was founded by the heirs of François Mosselman, who had acquired from Daniel Dony and his associates the calamine concession of Vieille-Montagne (Altenberg) which had been granted the former in 1806. The growth of the company from these small beginnings to its present status as the foremost zinc producer on the Continent, with activities extending over Belgium, France, Algeria, Tunisia, Germany, Sweden, England, and Italy, has already been described in these pages[1] by M. Gaston Saint-Paul de Sinçay, the general managing director of the company. It is unnecessary for me to refer to it, therefore, save to point out that during this span of years, stretching over almost an entire century, certain traditions have grown up, and that one of these is that Vieille-Montagne must look after its employees.

So it is that in his report to the stockholders M. de Sinçay says: "Faithful to tradition, you will unhesitatingly approve this series of measures for the benefit of the employees and workmen." He says, further on: "If the financial, commercial, and industrial situation of the company presents itself favorably to your examination after the events that have shaken the strongest businesses to their foundations—if during this period of 90 years the invested capital has received a fair remuneration—you are entitled to feel legitimate satisfaction in the thought that your company may be placed in the front rank of those who have organized and subsidized social works in favor of their staff of engineers, employees, foremen, and workmen, in order to associate them in a practical and rational way in the prosperity of your industry.

"The moral work presents as great an interest as the material work."

This last utterance is significant. Who will deny that it is most unusual in a company's annual report?

THE SCOPE OF THE WORK

In Vieille-Montagne's welfare program one sees the result of faithful adherence to tradition. It has developed slowly, having had its beginnings at a very early day in the organization's history. To comprehend the sincerity of the purpose underlying the program, one must understand the sympathetic attitude of the directors toward the great body of employees whose welfare is so largely under their control. In the workers' lives, they distinguish three periods. The first of these finds the

[1] "Vieille-Montagne—A Pioneer in the Zinc Industry." *Engineering and Mining Journal-Press*, Jan. 2, 1926.

workman young, care-free and improvident. He can save a part of his wages, but, as a general rule, he does not do so. In the second period comes marriage, children, family expenses. These often do not permit him to save, despite the best intentions. In this period he should be helped and his burden lightened. The third period is one of advancing years. The workman can no longer produce as much as formerly. His retirement is now but a matter of a few years. Left alone, he will in most cases quickly find himself in want or else dependent on others who have their own burdens in addition.

Social questions such as these have been handled on broad lines by the company, since its foundation. The motives actuating the directors and their predecessors have been expressed by M. de Sinçay in the following words: "To procure happiness to man in work and by work; to associate capital and labor in a common effort."

The wide scope of the program may be indicated by recounting briefly the various activities and enterprises included in it. These welfare and related features are:

A savings fund for the clerical staff and workmen.

A housing plan, under which employees may acquire their own homes or rent them at a low charge.

A commissary system under which less than prevailing retail prices are charged.

Welfare Work

A fund to provide relief for workmen and their families in case of sickness or accident. From it also pensions are paid.

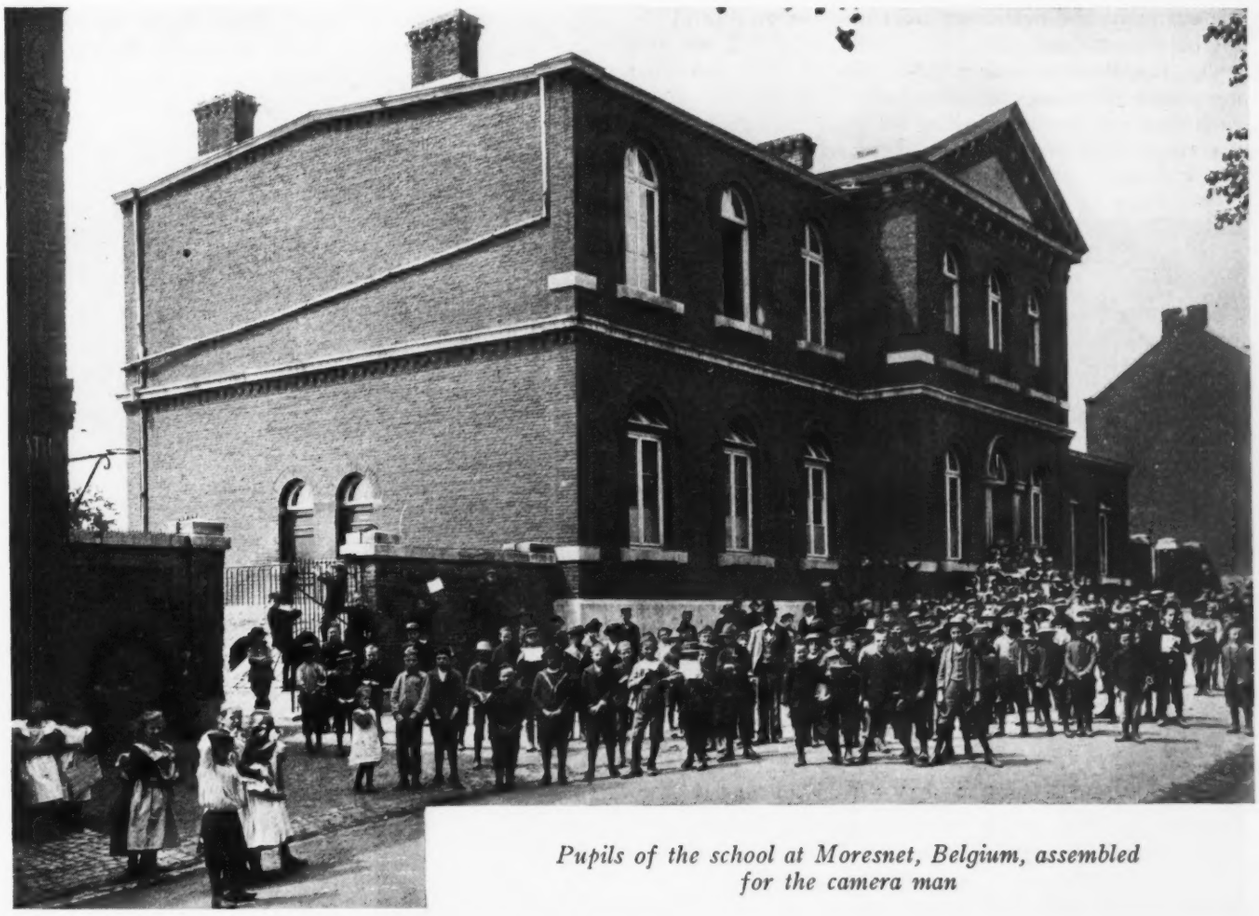
A pension fund for the clerical staff and their families. To this the company and the staff contribute.

The Cointe Home at Liége for orphans and aged workmen. Also a similar institution at Baelen-Wezel, Belgium, as well as others that serve the company's enterprises in Sweden, France and Sardinia.

Before going further into the details of these matters I wish to impress upon the reader that the entire expense for the welfare work is borne solely by the company. No moneys are received from the state or from the world outside the company's walls. No tickets are sold for benefits or the like, nor are lotteries held.

Vieille-Montagne was in the fifth year of its existence when, in 1842, it instituted its savings fund, which now totals approximately 26,000,000 Belgian francs, or about 9,000 francs on the average for each account. Deposits are credited with a higher rate of interest than that paid by savings institutions of the state. To create a taste for saving, the directors believe, contributes to the development of habits of order and economy. The success attained by this institution is attested to by the number of depositors.

As the result of the company's housing plan about 3,000 of the 15,000 Vieille-Montagne employees now own the homes in which they live. This has been made possible by loans made to them by the company, without



Pupils of the school at Moresnet, Belgium, assembled for the camera man

Workmen's homes at Baelen-Wezel, Belgium. Here Vieille-Montagne has erected an entire village of 300 substantial dwellings for its employees. Gardens are added wherever possible

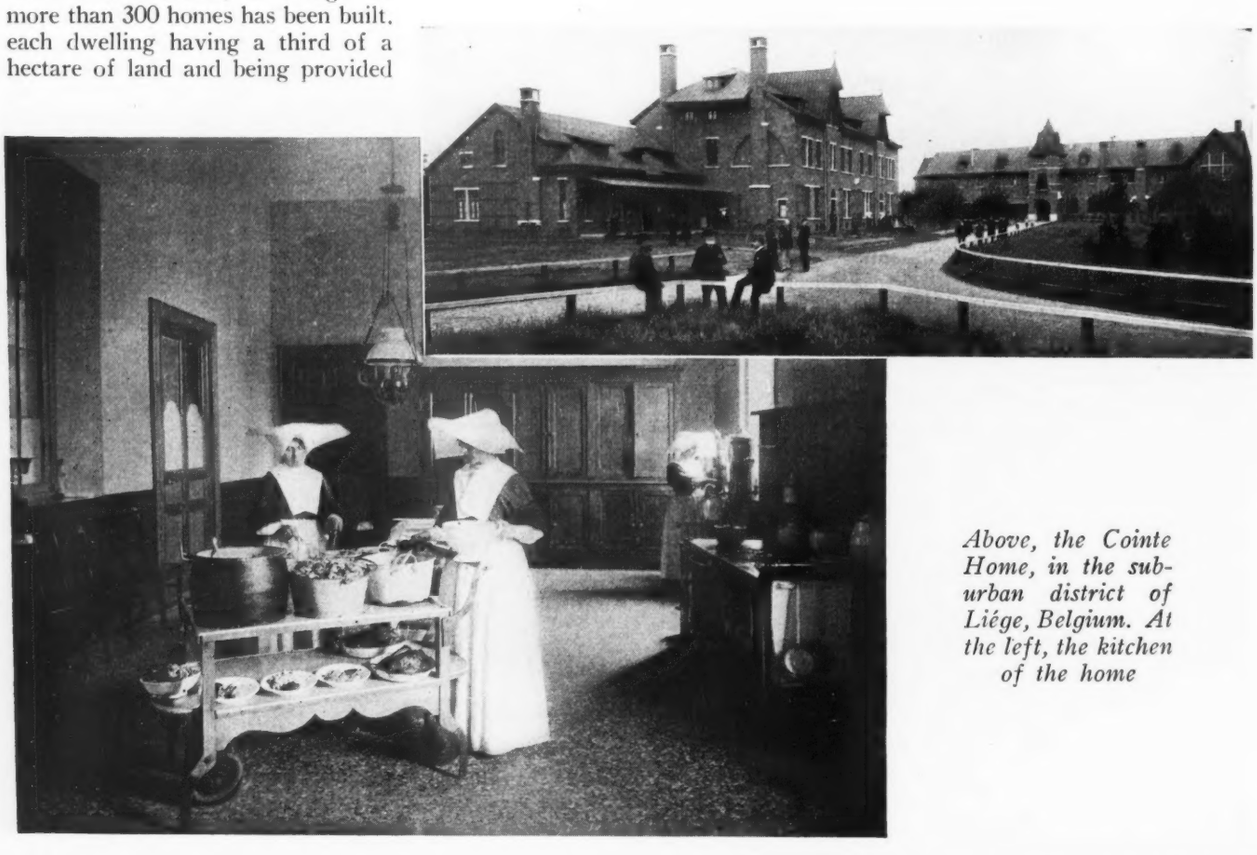
interest. A further 3,000 workmen have been provided with houses at low rentals and having, in most cases, gardens suitable for cultivation.

It is natural that the average workman should desire to establish a home and raise a family. The company endeavors in every way to help him to do so. The houses that have been built are comfortable and substantial. Some of them are seen in one of the accompanying photographs. Whenever possible, gardens are added by the company, and outhouses erected to permit the breeding of domestic animals.

At Baelen-Wezel, a village of more than 300 homes has been built, each dwelling having a third of a hectare of land and being provided with water and electricity. In other districts, similar measures, suited to requirements, have been adopted.

In connection with nearly all of its metallurgical plants and mines the company operates large general stores and canteens. At these the workmen are able to secure practically everything they need at lower prices than they would pay elsewhere.

Perhaps the most prominent welfare measure and one that was established eighty-one years ago, in 1847, is the workingman's relief fund. From it grants are made, wherever cases of need arise, whatever be the cause.



Above, the Cointe Home, in the suburban district of Liége, Belgium. At the left, the kitchen of the home

Whether this be due to sickness or accident or to the death of the supporter of a family, it is alleviated through the agency of the fund. From this fund pensions also are paid to incapacitated workmen, provided they have been in the company's service for fifteen years. All workmen are pensioned on reaching the age of sixty-five. At the beginning of 1927 such pensioners included 698 workmen, 1,131 widows, and 266 orphans, the required outlay for the preceding year being 2,125,000 francs. This fund is provided through a reserve of 20,000,000 francs inscribed in the balance sheet, without any tax on wages whatever.

It should be noted here that the law provides for payment to workmen in case of injury. The legal payments are often supplemented, however, by the company from the benefit fund.

In one of the accompanying illustrations is shown the Cointe Home, an asylum maintained by the company in the suburban section of Liége. This was founded by a fund established by the directors in 1892. Here old and disabled workmen find a refuge, subject only to a small contribution taken from their pensions. Married couples are not separated.

Here at Cointe, also, the orphans of workmen are received, without charge, and given a practical education. A convalescent home is also maintained in connection with the asylum.

Before I lay down my pen, let me say that the Vieille-Montagne company subsidizes schools and encourages all creeds without discrimination. It fosters sports among its employees. In short, in the words of M. de Sinçay, it associates itself with all moral work that claims its support. Moreover, if an employee behaves, he has a position for life no matter what the condition of business may be.

The company's charter, originally granted for 90 years, expired in 1927. It has been renewed for 30 years. The social work will continue, hand in hand with the material, and with it the record of the company's achievements.

Iron-Ore Output Fell Off Slightly in 1927

IRON ORE mined in the United States in 1927 amounted to 61,741,100 gross tons, a decrease of about 9 per cent as compared with 1926. Compared with the average for the preceding five years, however, the production was greater by about 3 per cent. Operations in the northeastern states were on an increased scale, especially in New York and Pennsylvania, in which increases of 34 and 7 per cent, respectively, were recorded, and there was an increase of 6 per cent in New Jersey. More ore was mined also in North Carolina, Virginia, and Montana in 1927 than in 1926, but in all the other iron-ore producing states mining was on a reduced scale.

Shipments of iron ore in 1927 amounted to 61,232,473 gross tons, valued at $151,125,820, a decrease of 12 per cent in quantity and of 13 per cent in total value as compared with 1926. The average value per ton of iron ore at the mines in 1927 was $2.47, which is about four cents less than in 1926. The stocks of iron ore at the mines at the end of 1927 amounted to 10,104,673 gross tons, compared with 9,565,880 tons at the end of 1926, an increase of about 6 per cent.

Iron Ore Mined in the United States, by Mining Districts and Varieties, 1926-1927,

In Gross Tons

(Exclusive of Ore Containing 5 Per Cent or More of Manganese)

District	Hematite	Brown Ore	Magnetite	Carbonate	Total
1926					
Lake Superior (a)	57,143,407	.....	.....	.....	57,143,407
Birmingham	6,114,917	393,300	.....	.....	6,508,217
Chattanooga	198,574	68,550	.....	.....	267,124
Adirondack northern New Jersey and southeastern New York	.....	.....	(b) 847,966	.....	(b) 847,966
Other districts	(b)(c) 1,177,675	(c) 349,074	1,327,322	2,215	(b) 2,856,286
	(b)(c) 64,634,573	(c) 810,924	(b) 2,175,288	2,215	67,623,000
1927					
Lake Superior (a)	51,539,880	.....	.....	.....	51,539,880
Birmingham	5,857,326	437,487	.....	.....	6,294,813
Chattanooga	89,351	70,897	.....	.....	160,248
Adirondack northern New Jersey and southeastern New York	.....	.....	(b) 1,073,819	.....	(b) 1,073,819
Other districts	(b)(c) 1,018,986	(c) 235,094	1,415,767	2,493	(b) 2,672,340
	(b)(c) 58,505,543	(c) 743,478	(b) 2,489,586	2,493	61,741,100

(a) Includes only those mines in Wisconsin which are in the true Lake Superior district.
(b) Some hematite from "Other Districts" included with magnetite from Adirondack district.
(c) Some hematite included with brown ore.

Waste of Sulphur in Smelter Gases

IN A paper presented before a recent meeting of the Canadian Engineering Institute. W. H. De Blois disclosed interesting statistics on the amount of sulphur contained in gases discharged from smelting plants of the dominion. According to him, 1,500 tons of sulphur is going to waste each day from the Canadian smelters. The possibility of recovering a part of this sulphur, for commercial use, is of particular interest to Canada, with its import balance of approximately 200,000 tons of sulphur, valued at $3,000,000, per year.

Possible methods of utilizing this waste sulphur were discussed. The imported sulphur is used largely by the pulp and paper mills, and it is considered practicable to produce liquefied sulphur dioxide at the smelters for use in this connection.

According to Mr. De Blois, the first effort to recover any of the sulphur from these gases was made by the Mond Nickel Company at its Coniston, Ontario, plant, with which he is connected. At this plant early work in sulphur utilization was in the manufacture of sulphuric acid. The attempt was a technical success, but no market existed near by for any appreciable tonnage of sulphuric acid. More recently the tendency has been toward the sulphur dioxide liquefaction process.

Treatment of Potash Ores

A DETAILED study of drill cores obtained from potash test well No. 1, recently drilled in New Mexico, is being made at the Non-metallic Minerals Experiment Station of the U. S. Bureau of Mines at New Brunswick, N. J. Laboratory tests have been made of material from a promising bed of sylvite.

The well-known German method of fractional crystallization can evidently be employed with success on the American salts. The process of recovery of sylvite, KCl, from beds of this character is probably simple, and can readily be worked out. Work is now being done on design of a plant for the above-mentioned process and on the approximate cost of potash concentration. The mineral polyhalite is abundant in the cores received. A study of its possible utilization will be undertaken. The insolubility of polyhalite and the presence of magnesium in it renders it difficult to treat.

Is Agriculture to Continue to Restrict Hydraulic Mining in California?

By JAMES D. STEWART[1]
Mining Engineer, Auburn, Calif.

JAMES D. STEWART

PLEADING the cause of the Hydraulic Miner comes natural to me, for I was born and reared within the sound of the roar of the hydraulic monitor and giant and my schooling and living has been wrested from the gravels of the hills I have always loved. For 44 years a few of us have kept the vigil and handed down from father to son and neighbor to neighbor, the faith to lift the cloud that has hung over our industry. The hydraulic miner has been most unfortunate in many ways, but most of all in the bitter, intolerant antagonism of his foes and his poor presentation of his own cause. The antagonism has practically disappeared, and today this persistent and insistent hydraulic miner counts more real personal friends in Marysville than anywhere in California. As to the presentation of his cause, we believe we are improving. When we are accepted into the society of such a select body as the Commonwealth Club, that is a step forward.

Hydraulic mining was stopped by injunction. The first was granted out of the state courts in 1881 against the Gold Run Ditch & Mining Company, and was followed by the federal court granting Timothy Woodruff an injunction against the North Bloomfield Company in 1884. In 1880 approximately 500 hydraulic mines were operating in the Sacramento and San Joaquin drainage areas. Of the $160,000,000 invested in mining of all kinds in California, at that time, over $100,000,000 was invested in hydraulic mines and their necessary equipment. This was wiped out in one blow. A portion of the ditches and water rights formed the nucleus of hydroelectric power plants. Some are used for irrigation purposes and others have gone to decay. All these years the hydraulic miner has gone on paying taxes on this property in the hope that a solution of the problem would be found.

Many tears have been shed over the losses of the farmer in the lowlands, caused by the débris from the hydraulic mines. This damage has been rectified and in many instances the land has been benefited. The filling of the beds of the streams raised the water above the hardpan table and has made possible the sub-irrigation of the great cling peach orchards of Yuba and Sutter counties. The river is nearly back to its old-time bed, and soon a wail will rend the heavens of the orchards dying for want of water. Contrast the position of the miner. He was not merely damaged, but wiped off the face of the earth. For more than 40 years he has waited for relief and has met with only sneers and scorn.

At the last session of the legislature, where we needed but one vote to win, a valley senator raised the cry of paternalism. A few weeks ago this self-same senator, at a meeting in Nevada City, told of the cling peach growers' troubles and stated that it was the intention to ask the next legislature for an appropriation of several hundred thousand dollars to pull the peach men out of their trouble. We do not know much about paternalism, but have some ideas on the subject. The miner has never fought anything in the way of legislation that would aid farming or any other industry, but he has not received any such treatment in return.

The people of the valley through all these years have protested any resumption of hydraulicking for fear of damage. But while engineers have been building great railroads and canals, conquering the depths of the sea and the heights of the air, they have also solved the problem confronting the hydraulic miner and the dweller on the floor of the valley. The efficient use of concrete in dams takes care of the permanent storage of the débris. Colonel Thomas H. Jackson, of the California Débris Commission, in a letter to the Mineral Resource Section, states conclusively and positively that dams can be built to impound the débris efficiently and permanently, so that it will not injure the lands further down the stream or the navigability of the stream. Otto von Geldern, eminent engineer, and representing the farmers of Sutter County in this discussion, agrees that this position is correct.

To point out the inconsistent and untenable position of the people of Sutter County in this matter: For years there has been in existence at Bullard's Bar, on the North Yuba River, a concrete dam 175 ft. high; and a half dozen or more hydraulic mines have been, and are now, operating behind it. The people of Sutter County say that this new legislation will deprive them of the right of injunction. This proposed legislation has not

[1]Mr. Stewart delivered this paper, in essentially the same form as presented here, at a recent meeting of the Commonwealth Club of California.

yet been passed. Why, then, do they not enjoin these mines? There is but one answer—the dam is efficient, and they cannot show any damage.

The next line of attack is that the hydraulic mining industry will not pay. This controversy has raged largely around one particular property or holding. Let it be understood that this movement is for the resumption of hydraulic mining in California; not for any particular property or holding. This proposed resumption must be so that every hydraulic miner owning property that is possible of being worked may have an equal opportunity to work his ground, if he meet and abide by the general conditions laid down.

The man to be listened to in this matter is the hydraulic miner who has held his property all these years, having faith that fair play would prevail in the future and that he might resume his operations instead of opportunity being created for promoters to unload or trade in holdings other than their own.

I have been a hydraulic miner all my life; my living and schooling have come from hydraulic mining operations; I have done, and am capable of doing, any and all things necessary to be done around a hydraulic mine with my own hands. And this is what this hydraulic miner proposes: That the state and federal governments make the necessary appropriations to build these dams. That these dams be built by, and be under, the supervision of the California Débris Commission as at present. That no dams be built on any stream until the hydraulic miners on that stream have filed a written petition with the California Débris Commission, asking that such dam be built, and deposited sufficient funds with the commission to cover the inspection of the project by the commission's engineers. That the petition shall state how many cubic yards of gravel the petitioner expects to work. That no dam shall be built until the petitioners file an undertaking or bond that they will work the amount of yardage stated in their petition. That when the dam is built, they will file with the commission a further bond to cover the payment of the storage of the débris behind the dam.

Some of the indirect benefits of hydraulic mining would be far more reaching and profitable than the direct benefits. Paul Bailey, in Bulletin No. 12 of the Department of Public Works, gives hydraulic mining a place in the water plans of the state. It will tie in with flood control, storage for irrigation, the lowering of the salinity of the delta regions, and will aid navigation by holding back the natural erosion from filling up the stream beds, and will release stored waters in the summer months.

Another important matter in the operation of a hydraulic mine is the stabilizing of the labor market. Most of the hydraulic work is performed in the winter months, and would tend to draw unemployed workmen away from the cities and provide employment for them until about the time the farmer needed extra help.

Its greatest immediate benefit would be to drift mining. As drift mining is now conducted, it is necessary to drive long expensive tunnels to tap the channels. Where these are located under lava caps, a great deal of the preliminary work has to be done blindly. If hydraulic mining were permitted, a point could be selected where the latter-day streams such as the Yuba, Bear, American, or their tributaries had cut across the earlier-day channels, a hydraulic outfit installed, and operations continued as long as profitable. When no longer profitable on account of the increasing overburden of lava, the rims and bed of the channel being exposed, drift operations could be prosecuted with speed, accuracy, and economy.

Charles Scott Haley, in Bulletin No. 92 of the State Mining Bureau, estimates that $600,000,000 can be directly recovered by hydraulicking. Arthur Jarman, in his report to the last legislature, estimates considerably less for a twenty-year period. An engineer stated before the Mineral Section that his property would produce $24,000,000 gross; another property under my control will gross over $20,000,000, and another $6,000,000. Taking these as a basis, and my general knowledge of the workable gravel areas, I believe Haley made a fair estimate. Special conditions may prevent the working of a considerable portion of these deposits, but rich spots might increase the gold recovered measurably.

In 1908, a company of Chinese at You Bet took out $358,600 from a small spot, and nearly as much the year before. They began to hydraulic this ground, were stopped, and drifted the bottom out. Undoubtedly many such undiscovered spots exist. At Forest Hill, as much as $850,000 to $1,200,000 was drifted from 100 ft. in length of the channels. It is just as possible to strike such spots hydraulicking. As to the recovery from drift mining, that will be stimulated and aided by hydraulicking.

The tenth annual report of the State Mineralogist states that within the confines of Placer County over 200 miles of auriferous gravels have never been prospected, let alone worked, and that those that have been worked have produced from $500,000 to $5,000,000 per mile. This is a stupendous sum to think of, and though you may discount as you will, it still staggers the uninitiated. Nevada County has about three times as much as Placer; and Plumas and Sierra nearly as much each as Placer. El Dorado, Amador, and Calaveras have about half as much each as Placer.

The Caminetti Act became a law in 1893. It empowered the California Débris Commission to seize public lands upon which to build dams and store the débris therefrom, and to take timber and stones from public lands to build these dams. It empowered this commission to levy a 3 per cent tax on the gross output of hydraulic mines with which to construct dams. These provisions have not been carried out. I am not blaming the California Débris Commission for its laxness in this matter, but rather the almost criminal indifference of the hydraulic miner in not asserting his rights. Mayhap it is all for the best. The California Débris Commission has done a splendid job of cleaning the clogged streams of débris. If the commission gives half as much attention to the hydraulic miner in the future, he will come out all right.

It is often asked, if hydraulic mining be so profitable, why not construct these dams yourselves? First of all, the United States government has taken on its shoulders the strict regulation of hydraulic operations. If the private owner builds a dam, he must perforce impound and store the tailings from drift operations, farming operations, logging and grazing operations, and the results of natural erosion, for which he receives no pay, and most of this muck comes from Uncle Sam's domains within the forest reserves.

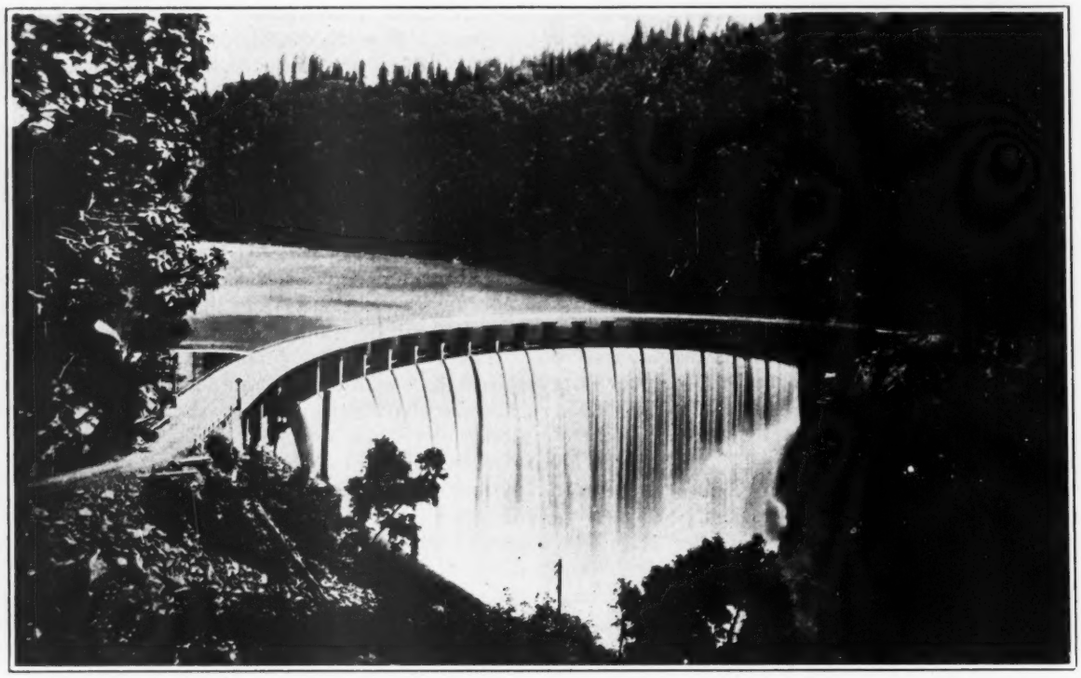
When hydraulic mining was stopped in the eighties, the hydraulic miner was dumping from 30 to 40 millions of cubic yards of material from the ends of his sluices into the canons and ravines that led to the main streams. A great deal of this never has and never will reach the main streams in any destructive form; not over 15 per cent ever went far enough down stream to do damage, and it was of a nature that it made productive land where

it lodged. At the same time there were great drift mines operating, some depositing over 100,000 cu.yd. per annum into the stream beds, against which there was no protest. The early-day miner loosened up all the jams and blockades in the stream beds and the flood of 1861 and 1862 carried this great mass of material to the low lands. Farmers on side hills turning the streams red with the results of their labor, grazing and logging add-

Our basis for asking help is largely because of the aid given by the federal government to practically every industry in the country: to some by direct subsidy and to others by indirect tariff aid. Contrasting this, hydraulic mining asks only a loan, to be repaid.

The following is for enlightenment, not criticism:

California's annual agricultural, horticultural, and cattle wealth hardly equals the value of its mineral pro-



Bullard's Bar Dam, on the Yuba River, 175 ft. high, behind which hydraulicking is being done successfully

ing their quota, and hydraulic mining is charged with the whole bill.

There has been a wail that it will be necessary to create new machinery to link the state and federal governments together in this enterprise. In the past, the State of California has made appropriations of $250,000 and $150,000, which has been matched by similar appropriations from the federal government and expended by the California Débris Commission to hold back the gravel in the stream beds for the protection of navigation and farm lands further downstream. If the present law permits this—and it surely does—then no further powers are necessary to have this commission build dams to hold back the miner's débris, for this is what this commission was created for: to aid hydraulic mining. Hydraulic miners fought a heart-breaking fight to gain this legislation, which so far has failed to function for their benefit.

As to economy in handling the débris already in the stream beds, and working into the streams from natural erosion, from other forms of mining, and from many causes other than hydraulic mining—it might be stated that it costs the United States government 0.06c. per cubic yard to dredge débris from the navigable water in the lower stretches of the streams. Dams built to hold back hydraulic mining débris will also retain all the aforementioned material at a cost of 0.005 to 0.03c. per cubic yard. This alone entitles it to consideration from an economic standpoint.

duction, yet this agrarian group has its place in the governor's cabinet. The great mineral industry has no place, but is grouped with the Fish and Game Commission, Parks and Forestry boards and the San Pasquale Battlefield Commission. California, in the two years ending before the last legislature, appropriated $1,399,000 for the agrarian group and $103,000 for the support of the State Mining Bureau. The agrarian group, by some small fees, reduced this to approximately $1,250,000, while the mining industry paid into the state treasury $568,000 in royalties which was divided among roads, schools, reclamation, and expense of administration. Not one cent was expended to encourage mining.

The state fair, which should be by, and for, all the people and industries of the state, it is run by a so-called agricultural society, which is no misnomer, for 81 per cent of the prize values go to agriculture, 1 per cent to the mineral industry, and the other 18 per cent to encourage all the other industries of the state. Several state fairs in the past decade have given $1,000 in prizes for pitching horseshoes, and a $70 prize for the finest gold exhibit. During the last twenty years, representatives from farming localities have introduced bills in the legislature to abolish the State Mining Bureau altogether. When I run these things through my mind, I wonder why it is necessary for this state to import $50,000,000 worth of pork products annually. I don't mind a few bristles, but when it comes to the whole pig, it's time to object. So much for the state.

The mining industry has no place in the executive departments of the United States, but is booted from one department to another. Commerce, Labor, and Agriculture, however, have their representatives in the Cabinet of the President. The agrarian group produces about $12,000,000,000 annually and the mining industry about half as much. The mining industry provides half the tonnage of the railroads of the country. But agriculture will receive from the government this fiscal year about $130,000,000 of aid; whereas mining gets less than $5,000,000. The mining representatives in our law-making bodies are ever striving to be neighborly and aid the other fellow, while agriculture forms in blocs holding up every industry right and left like a peeved child or stubborn mule. The hydraulic miner is the victim of this intolerant attitude.

Under the Caminetti Act, a miner applies for a permit to hydraulic, is given the plans for a dam by the California Débris Commission, builds it under their direction and supervision, and is granted a license to operate by the hydraulic process. He keeps a daily record of the yardage washed, the amount of water used, and the condition of the dam and pool behind it. This report is sent to the commission every 30 days. From time to time the commission's engineers inspect the works, and if not in proper order, or for the violation of any rules, the license is revoked without a hearing. In the face of all this, wandering deputy sheriffs from these valley counties serve injunctions on these miners working lawfully under U. S. government license. If the miner persists, he is charged with contempt of court by his accuser, tried by his accuser, convicted by his accuser, and sentenced to punishment by his accuser. William Nicholls, operating lawfully under U. S. license the Polar Star mine, at Dutch Flat, was a victim of such an outrage in the Sutter County courts, was fined $500 and sentenced to five days in jail. This is one of the inequities the Sutter County opponents of hydraulic mining are striving to maintain. We hydraulic miners are willing to be tried in neutral courts, and abide by the decision, but we will not acquiesce in such an affront to justice, fair dealing, and jurisprudence.

We do not ask for the unlimited and unlicensed hydraulic mining of the past, that did its share of damage. However, we resent being charged with all the damage that has been done the streams by other forms of mining and industry. We are willing and must keep our operations from injuring the other fellow. We have a right to ask and demand aid from a government that owes its existence to the gold from California's hydraulic mines, and silver from Nevada's hills, during the Civil War. For prior to this strife, California's mines had produced approximately $600,000,000 in gold, and during the conflict nearly $200,000,000 or more. It was this golden flood that saved the nation's credit, and, as much as the soldiers, won the fight.

The section of Mineral Resources of the Commonwealth Club has listened to all angles of this discussion. The Harbor section found in our favor, Power section offered no objection, and irrigation representatives espoused it. Paul Bailey, State Engineer, has recommended it. Alexander R. Heron, chairman of the State Board of Control, in a letter to me, dated May 12, 1927, states among other things, "As a matter of fact, I think every sensible person is interested in the resumption of hydraulic mining as an important branch of the California industry."

Halsey H. Dunning, one of the largest owners of property in the Marysville area, and all protected by levees, says, "We own about 400 acres of land in the Yuba River bottom. I am not in the least alarmed in regard to the resumption of hydraulic mining. From experience I know that with dams such as the Bullard's Bar dam, and the work that the government has done the past several years with the control of the dredger operations, no harm can come from mining on the Yuba River. I remember the flood of 1875, before any levees were built on the Yuba River, and have worked probably more hours on levees with shovel and sacks of sand than any man in Yuba County; so I think I know conditions. Build all the dams you want like the Bullard's Bar dam, and mine all you want, and you will do more than most any other industry for the valley."

I could quote endlessly to refute the hysteria-breeding politicians of Sutter County, but such a frank declaration from such a source should be conclusive.

The Hydraulic Commission reported favorably to the last legislature, in the face of the opposition of the dominating faction, which exerted every resource in its power. We came within one vote of making it a law. The Mineral section has brought in a majority report favoring it, and the minority report is by the engineer employed by the people of Sutter County, who happens to be a member of this section. The section has done this, after a most thorough discussion of all angles, from August 10, last. In the face of all this, I ask that a decision be given for the hydraulic miner.

Electroplating on Aluminum and Its Alloys

DESPITE the valuable characteristics of lightness and ease of manufacture, aluminum has not attained commercial importance in the field of plated metals. Most previous attempts to plate on aluminum for trade purposes have proved unsuccessful, owing to its peculiar position in relation to other metals in the electromotive series and the problems which this position presents. Consequently, urged by the necessity for developing a more favorable means of electroplating on aluminum and its alloys, the Aluminum Company of America established a research fellowship at Mellon Institute of Industrial Research in 1925. After a study of nearly three years, the results of the fellowship's incumbent, Harold K. Work, were recently presented at the fifty-third general meeting of the American Electrochemical Society held at Bridgeport, Conn.

After the surface has been cleaned and rendered active, the most successful method to be developed by Mr. Work then submits the aluminum to a roughening process. This is accomplished preferably by chemical etching, which consists of placing the metal in an acid-metal or acid dip, the composition of the dip being determined by the alloy to be plated. When the alloy is such as will take a high metal dip, the surface of the aluminum is not only pitted by the action of the dip, but an immersion layer surface is formed which greatly facilitates plating. Pits thus formed in the surface of the aluminum serve to secure the plating. The roughened metal is then immersed for the first coat in a nickel-plating bath, to which an electric current is applied.

A nickel finish over aluminum is particularly desirable, since the similarity in the color of the two metals renders worn spots in the plating less perceptible, and the white corrosion products are more easily removed than those of other metals.

Mining, Milling, and Smelting at Superior, Arizona

Part VIII of "Revisiting Arizona Mining Camps"

By E. H. ROBIE
Associate Editor

THE mine, mill, and smelter of the Magma Copper Company are all within a short distance of one another in the town of Superior, Ariz. Ore is transported by rail, instead of by the aërial tram formerly used, from the mine to the concentrating plant, a distance of about half a mile, and from there the concentrates are pumped another half mile to the smelter. Normal production is about 700 tons of ore per day, with an average content of about 6 per cent copper. Part of this goes to the smelter direct. Development is carried on through three shafts, Nos. 2 and 3 having been the main operating shafts until the fire on Nov. 24, 1927, which put No. 2 out of commission. Development work is now being done through No. 5 shaft, and Nos. 1 and 4 are upcast shafts.

William Koerner, general manager of the company, explained, in more detail than I can give here, his theory of how the fire started and the conditions that obtained at that time. The actual cause will never be known, but the indications are that the fire was started by the careless disposal of a cigarette or match, the sequence of events not supporting the theory of electrical origin that was first held. The shaft was concreted from the 650 to the 1,200 level, and gunited from the 1,200 to the 1,600, otherwise the fire would doubtless have caused even more destruction than it did. As it was, the timbers were destroyed from the 2,250 up to the 1,400 level. Retimbering was in progress in the burned section at the time of my visit. Some trouble has been experienced from decay of the timbers under the gunite coating, and it has been found particularly difficult to determine just how far such decomposition has gone. Obviously, a gunite covering cannot prevent the growth of a fungus in the timber if the germs of such fungus have already been implanted in the pores of the wood. In such circumstances, some impregnation with a wood preservative would be necessary before the timbers are gunited.

E. G. DENTZER

Ore is now being mined principally in the 2,000- and 2,250-ft. levels, that on the 2,250 being of higher grade than that above. The 2,500-ft. level is being opened, and some ore has been developed in the sinking of No. 5 shaft, and to the west of the major fault, in ground not heretofore productive. Two Butler shovels are in use for development work, principally for cutting out sills in new stopes. They have been very satisfactory, though there has been some difficulty in getting them taken care of properly. They are also in use at Cananea, I understand, and promise to receive increasing application at other properties. They are especially advantageous in hot ground where hand shoveling is particularly arduous. One is impressed by the straight, clean drifts that are cut by this method.

The Magma ore is of two kinds: oxidized material from above the 650 level, which contains better than 10 per cent copper, 7 to 8 oz. of silver, and a slight amount of gold; and sulphide ore, chiefly chalcopyrite, and bornite, with a little pyrite. The oxidized material is now a very small part of the total mine production. Some of the sulphide is sufficiently high-grade for direct smelting, but most of the tonnage goes to the concentrator.

Few changes have been made in the mill equipment in the last few years, the flow sheet being a conventional one, with ball-mill grinding and flotation in Callow cells. Tabling precedes flotation, the table tailing being reground for the flotation feed.

The following analyses cover the results that have recently been secured over an extended period, all the figures being in per cent except those for silver and gold, which are in ounces per ton, as usual:

Analysis of Mill Feed and Products

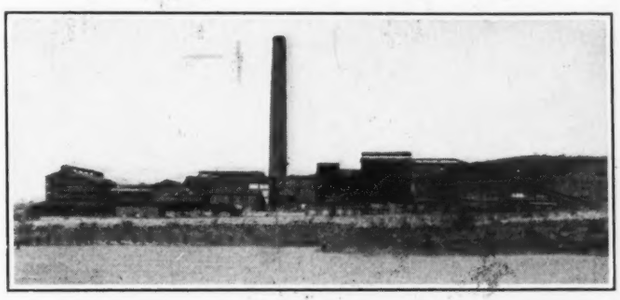
	Cu	Ag	Au	Fe	CaO	Al_2O_3	SiO_2	S
Mill feed	5.38	2.73	0.026	13.3	1.0	8.0	52.5	12.7
Table concentrate	13.60	8.51	0.086	31.7	0.7	2.2	10.4	36.0
Flotation feed	3.60	1.87	0.01	8.9	1.0	8.2	62.1	8.4
Flotation concentrate	16.15	8.29	0.085	25.6	0.8	3.4	17.9	28.7
Final tailing	0.168	0.12	Trace	5.5	1.3	10.6	73.6	2.2

Average recovery is about 98 per cent. The usual flotation reagent used is the well-known "T-T" mixture—thiocarbanalide and orthotoluidine—though at the time of my visit a two-months' test had just been finished in which Aërofloat was used (phosphocresylic acid). Indications were that the Aërofloat was slightly cheaper, but that on this ore the metallurgical results were not quite so good. The circuit is made alkaline with lime. Sometimes a little xylidine is added when more frothing is needed.

J. H. ROSE

It may be remembered that this plant attracted attention when it was built because, for one reason, it was decided to pump the concentrate from the mill to the smelter, where the filter plant was installed, this being

considered the most economical means of transportation. This method is still in use and has been very successful. The distance pumped is about 2,600 ft., and there is a rise of about 90 ft. over a hill. The 4-in. Wilfley pump used in this service handles about 100 tons of pulp an hour, and the runners, having a life of from 30 to 40 hours, may easily be renewed. The material pumped is about half table concentrates, which are minus-12 mesh, and half flotation concentrates, which are minus-65 mesh, and the matter of density is rather critical. If the pulp is too thin, the concentrate will settle out, and if too thick there is difficulty in pumping; about 65 per cent solids gives the best results. The pump is driven by a 75-hp. motor and it is fully loaded. Ordinarily, pumping is continued for only two or three hours a day, in which about 225 tons, the average daily output of the mill, is transported to the smelter. At the filter plant the mixture of coarse and fine concentrates makes a problem, for unless thorough agitation is carried on in the hopper of the drum filter, segregation will take place



The Magma smelter. The pond in the foreground is an unusual feature of the Arizona landscape hereabouts

and the bottom will become clogged. The new 12x12 Oliver filter, however, has mechanical agitation, which produces better results than the air agitation formerly used. Two other smaller Olivers are in service and there is also a 12x12 Oliver filter with air agitation. A filter cake containing about 14 per cent of moisture is obtained.

Arriving at the Magma smelter, I found J. H. Rose, mill and smelter superintendent, climbing down the stack. A sampling station for stack gases gives the appearance of a parasitic growth on most smelter stacks nowadays. Some record of what goes out of the stack is advisable for two reasons: first, to afford information on smelter losses in dust and fume, and, second, to enable the operators to know the amount and character of gases discharged into the atmosphere that may be detrimental to the animal or vegetable life in the vicinity.

The Magma smelter is one of the newer reduction plants of the country, having been built in 1923. Its equipment has already been described in this magazine; it includes a filter plant, bins, five eight-hearth Herreshoff roasters, one reverberatory, and two upright Great Falls type converters.

The roasters handle about 100 tons a day each, reducing the sulphur from about 20 to 12 per cent. They are 19 ft. inside diameter. Their work has been very satisfactory, though newer models of this furnace have an improved method of attaching the rabble arms to the shaft, so that the more or less troublesome operation of bolting them on is obviated.

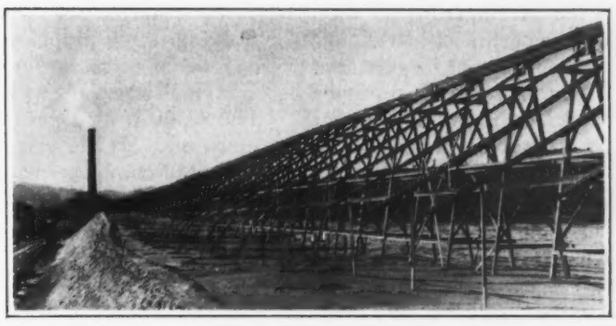
The reverberatory is 22x96 ft., inside dimensions, using conventional side charging. The arch is of 20-in. silica brick, except that the crown of the arch near the bridge wall is constructed of 15-in. brick. Tapping blocks are constructed of magnesite brick. The roof extends in a straight line toward the flue, and lasts close to a year without repair. No attempt is made to cool the brick when they become thin; when they get dangerously so, the furnace is shut down for about ten days. Ordinarily, only the bridge wall and the first 20 ft. or so of the roof beyond it require renewing, and about 120,000 tons of ore can be smelted between such repairs. A little fettling is charged along the bridge wall, in front of the oil burners; the rest of the material added to the furnace is all put in along the side walls, except the molten converter slag, which is poured into the furnace under the center of the arch near the bridge wall in the usual way.

J. C. MCNABB

Formerly, the walls of the flue end of the furnace were considerably thicker than elsewhere, the outside of the furnace being rectangular, whereas the inner walls curved inward towards the skimming bay. This resulted in a deteriorating effect on the brick owing to the lack of opportunity for the escape of heat; therefore, some of the brick on the outside were removed, to a wall thickness of 18 in., a procedure that had satisfactory results.

About 330 tons of solid charge is smelted per furnace day, and the fuel required, during 1927, was 0.63 bbl. of oil per ton of solid charge (1 bbl. of oil = 42 gal). Skimming is performed twice a shift. Draft in the flue is maintained at 0.05 in. of water, as the boilers will smoke if it drops below this. One man on each shift devotes his time to keeping the tubes of the boilers clean. The boilers at this plant seem to be placed rather higher than is advisable, the flue gases being led upward from the furnace, at right angles on each side, to the boiler passages. A more direct horizontal passage, like that designed for the new Copper Queen plant at Douglas, is a more desirable arrangement. The gas velocity in waste-heat boilers must be considerably less than that which is considered good practice in ordinary boiler installations, on account of the dust factor.

The reverberatory slag in 1927 averaged as follows: Copper, 0.40 per cent; iron, 33.2; silica, 38.9; alumina, 5.6; and lime, 6.3 per cent. At the time of my visit the silica content was somewhat higher that that shown by these figures—from 43 to 45 per cent. Though this is an unusually siliceous product, no particular difficulty was experienced in furnace operation apparently. The converter slag is also quite siliceous—about 25 per cent—owing to the effort made to smelt as much ore as possible



Distributing the Magma tailings. The smelter is in the distance

in the converters. The matte during 1927 averaged 36 per cent copper.

Converter practice follows conventional lines. One of the two shells is kept as a spare. Repairs along the tuyère line are made about every three months.

The organization of the Magma Copper Company now provides for control of the mill by the smelter superintendent, James H. Rose; his assistant, J. C. McNabb, maintains his office at the concentrating plant. E. G. Dentzer assists William Koerner, the manager, in superintending the work at the mine, the mill, and the smelter.

I was indebted to Mr. Koerner for a ride to the property of the Belmont Copper Mining Company, three miles south of Superior, on the afternoon of March 9. The day being fine, I had thought of walking to the property, but one often forgets that it may be as necessary to inquire how far up a property is as well as how far away, especially if the day be warm. The road up to the Belmont property is somewhat tortuous, and Mr. Koerner considered it an excellent test of the hill-climbing qualities of his new Dodge coupé. I may say it performed splendidly, as did the equally new Dodge sedan of Chester Hoatson's.

Surface plant of the Belmont Copper Mining Company near Superior. The flotation mill is at the left

The property being operated by the Belmont Copper Mining Company lies two miles south of the Magma property and ranks next to it in interest and importance. It is controlled by Scotch and Michigan interests, the Scotch interests being the Alexander Mackays, of Dundee, Scotland, and the Michigan interests being some of the directors of the Calumet & Arizona Mining Company. Arthur J. Smith, of Phœnix, Ariz., is secretary and treasurer and Chester Hoatson, of Superior, Ariz., is vice-president and manager.

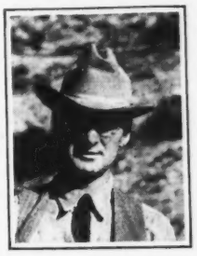
The general geology of the Belmont property is essentially the same as that at the Magma property and in many respects similar to that at the Old Dominion property at Globe, Ariz. A general geological column at the Belmont property indicates a basal formation of Pinal schist (exposed three miles to the west and four miles north), upon which has been deposited a series of Paleozoic sediments consisting of conglomerates, shales, quartzites, and limestones. The entire series presents the appearance of a conformable sequence, but at least two disconformities are known to exist. Intrusive into the sediments at the Mescal limestone horizon is a sill of diabase known to be more than 2,200 ft. thick at the Magma property and more than 900 ft. thick at the Belmont. Development work at the 700 level and on several deeper levels disclosed a number of blocks of Cambrian limestone of various sizes completely engulfed in diabase. The lower or Dripping Springs quartzite has not yet been revealed in the Belmont workings.

The ores so far developed are deposited along a number of east-west fault zones along which some post-ore movement has taken place, which drags the orebodies apart and complicates development. Movement along any of the veins is not more than two or three hundred feet. Ore minerals in the order of their importance are: pyrite, sphalerite, galena, chalcopyrite, argentite, proustite, and pyrargyrite, with small amounts of native silver and gold. The ores in the veins where diabase forms the walls were formed by replacement of shattered diabase, there being no evidence of any great amount of open space filling.

A small tonnage of silver-gold-lead-zinc ore has been developed in one of the veins between the 1,000 and 1,450 levels, which is being treated in a small flotation mill that went into operation soon after my visit in March. The property is being developed by means of drifts, crosscuts, raises, and diamond-drill holes from several levels through a 1,650-ft., three-compartment vertical shaft. All equipment is electrically operated, power being secured from hydro-electric power plants operated

by the Salt River Valley Water Users' Association, at Roosevelt dam, on Salt River. Approximately 150,000 kw.-hr. per month is consumed, at a cost of 8½c. per kw.-hr.

A bulk flotation mill with a daily capacity of 75 tons was being installed at the time of my visit, and has now been in operation about two months. The flow sheet is simple, consisting of a 9x11 Blake jaw crusher which crushes the crude ore to ¾-in. mesh. A 6x22 Hardinge conical ball mill in closed circuit with a Dorr classifier does the fine grinding and a bulk concentrate is discharged from a 10-ft. Hunt flotation cell of special design. Gravity tables are not used. A 1,200-cu.ft. Roots low-pressure blower furnishes air for the flotation cell. The concentrates are pumped to a suitable drying and sacking plant by means of a 2-in. Wilfley sand pump.



CHESTER HOATSON

Mr. Hoatson has since written me that the first month's operation on one shift daily yielded good recoveries by using xanthate and pine oil at the classifier overflow and cresylic acid at the ball mill. Necessary alkalinity was maintained by introducing sodium carbonate into the classifier. The ratio of concentration is 16 to 1, 91 per cent recovery on silver and 97 per cent on gold. Concentrates average 177 oz. silver per ton and $8 gold per ton. At present, only ore being produced from development work is milled, no attempt being made to produce from stopes.

Development work on two promising veins is being prosecuted on the 1,450 and 1,620 levels in addition to raises in ore which are being driven through to the upper levels to provide ventilation and additional tonnage.

The ride from Superior to Miami and Globe is a rather thrilling one for the first few miles. The road is an excellent one, but it passes up through some of the roughest country that a traveler can find anywhere. I would have preferred to make the ride by daylight, but the evening stage schedule suited me better, so I determined to leave at 8:25. However, it was two hours later before the bus made its appearance, such delays being rather uncommon, I understand. The bus service in Arizona is really excellent. Instead of the touring cars of a few years ago, large inclosed buses are now in use on all of the most traveled routes, and the service is, in general, superior to that afforded by the branch lines of the railways. For two weeks I did not set foot on a train. On the Coast, some of the buses have sleeping and toilet accommodations. For long-distance travel, however, I prefer the train, as it is faster, cleaner, and affords better traveling company. Where the stages are directly competitive with the railroad, the fares are about the same, or perhaps a little less—namely about 3.6c. per mile; but where there is no such competition I found that the fare ranged up to 14c. a mile. Perhaps 6 or 8c. would be a fair average.

But I am wandering. After various rumors to the effect that the bus had upset in a ditch a little ways down the road, it finally appeared. At night the approaching bus can be spotted by the extreme distance between the headlights of this Colossus of the Roads (a poor pun, perhaps, but my own). At 10:30 we set out for the 21-mile trip to Miami up the fearsome canyon road by moonlight. The delay had not been particularly reassuring, and we had not gone far before we had to pull over to the side of the road, the generator refusing to function. I was sitting alongside of the driver, and was of such assistance as I could be in this predicament, which was none at all, so we finally proceeded on our way, with most of the illumination of the roadway furnished by the moon as it ascended in the east while we ascended in the west. At night one may shudder at the phantom shadows and meditate upon the possibilities of dropping to unseen but not unsuspected depths, but as a matter of fact, the drivers tell me that they prefer night driving around hairpin turns to the same adventure by day. Headlights are visible for some distance ahead, even around the sharpest curves, and the travel is not so heavy. The journey to Miami was successfully made in an hour, and it only remained to wake up the night clerk at the McNeil Hotel before turning in for the night.

(The next installment of this series, to appear next week, will take the reader to Inspiration, with a glimpse of the leaching plant.)

The Engineer as a Citizen

THE compelling argument for the enlistment of engineers as citizens is the plain every-day fact that politics has not kept pace with science. That marvelous manifestation of efficiency that has speeded up our industries possibly beyond the limits of economic safety has no parallel in government circles. I need not say how rapid is the march of improvement in industrial processes and methods. Each year beholds new scrap piles of obsolescent machinery, not old yet out of date—not worn out yet thrown out because there is something better. But rarely do we think of throwing out a political machine or of scrapping out-of-date political methods.

You will recall that early in our national history George Washington was an engineer citizen of the first rank. His practical and progressive leadership in affairs of state seems to be the natural outcome of his experience as a man of affairs—a civil engineer with a unique record as explorer and pioneer, a director of his own agricultural experiment station, a promoter of interstate waterways, and even a drainage engineer.

All of us can aspire to be useful private citizens, each taking such an interest in public affairs that in the aggregate the political contribution by engineer-citizens will become a constructive and conserving power throughout the land. We engineers will do well to develop that kind of class consciousness.—*From a recent speech by George Otis Smith.*

GRAPHITE is one of the non-metallic minerals produced so cheaply abroad that there is little encouragement for the development of a large domestic industry. Yet progress is being recorded. The flotation process is being applied with success in California, and a product is being made that compares favorably with any on the market. Mr. W. G. Hubler, of the Standard Graphite Corporation, gives in a forthcoming issue an outline of the milling and recovery methods used at the Company's plant near Los Angeles.

USEFUL OPERATING IDEAS

Portable Underground Concrete Mixer

By F. M. Keesling
Assistant Draftsman, United Verde Copper Company

IDEA No. 1

A CONSIDERABLE amount of concrete work in the form of door frames, bulkheads, ditches, and foundations for machinery is placed every month in the United Verde mine, at Jerome, Ariz. The need for a small, portable concrete mixer to supplant hand mixing was felt, but it was not until sliming operations to extinguish the United Verde fire were started, an increased number of bulkheads being necessary for this work, that such a mixer was constructed.

The mixer had to meet the following requirements: (1) clearance was limited to a 5 x 7-ft. drift; (2) truck mounting conformed to a standard mine type and to the curves of smallest radius in the mine; (3) excessive weight was to be avoided; and (4) the driving engine was to be operated by compressed air at 90 lb., electric lines not being available in all parts of the mine, especially on the upper levels, where most of the bulkheading was being done.

Data on a number of small mixers were examined, and it was decided to purchase a No. 3 Wonder, 3-cu.ft. tilting mixer manufactured by the Construction Machinery Company, Waterloo, Iowa. The mixer was purchased without engine or truck mounting. The truck upon which it was mounted was made of two 6-in. channels and standard Sanford-Day 12-in. wheels, having a 2-in. axle and 18-in. gage. This was a standard mine type in use at the United Verde.

Inasmuch as power for operating the mixer was to be compressed air, it was thought possible to rejuvenate a discarded Turbinair hoist and use it. However, a discarded hoist of this type was not on hand. Upon the suggestion of the master mechanic it was decided to use one cylinder of an Anaconda air hoist. This was mounted on a half-inch plate at one end of the truck and connected to the mixer through sprockets and chain. The chain was a Link-Belt No. SS433, which is rather heavy for the power transmitted. So much trouble had been experienced through the breakage of lighter chains on mixers employed upon the surface that it was felt that a heavier chain was warranted. A light metal guard was built over the engine to keep out dirt and to prevent workmen from coming in contact with reciprocating parts.

The machine as now equipped has the following dimensions: Over-all height, 4 ft. 6½ in.; over-all width, 2 ft. 10 in.; over-all length, 6 ft. 1 in.; wheelbase, 2 ft. 4 in. The lip of the mixer is 1 ft. 8¾ in. above the top of rail when discharging—high enough to permit a wheelbarrow to be placed beneath it.

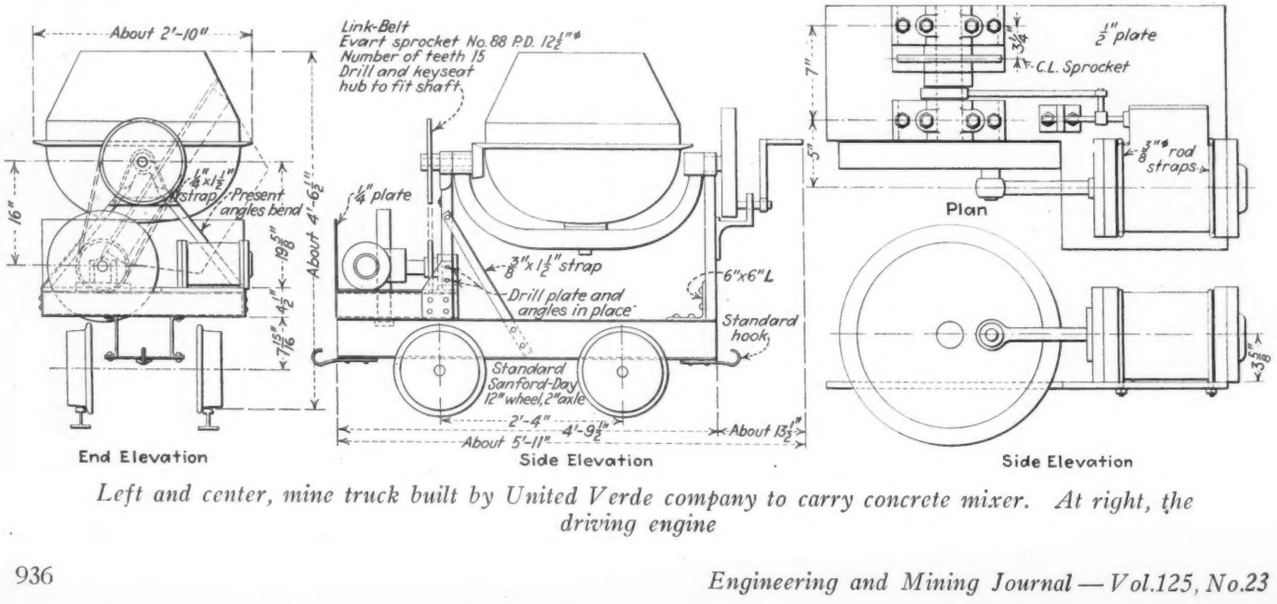
The mixer has been in operation for five or six months and has given satisfaction. Owing to the fact that a one-cylinder engine is used, difficulty is experienced at times by the engine stopping on dead center. However, when this happens the mixer can be started by turning on the air and shoving the drum.

Leveling Machinery

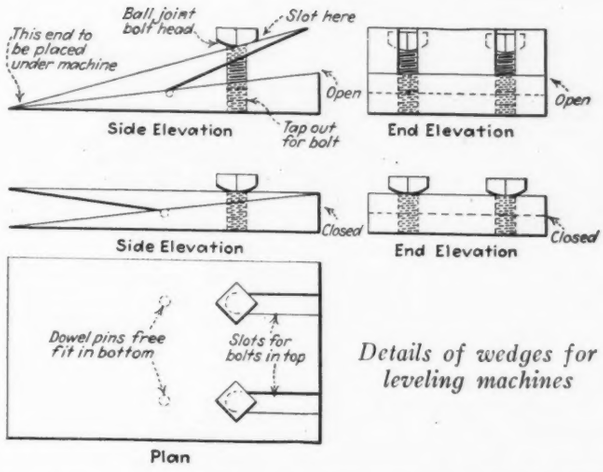
IDEA No. 2

WHEN it is necessary to level machinery it can be done accurately, quickly, and at little expense with wedges such as those shown in the illustration. The wedges should be made according to the size of the machine to be set, but the proportion given in the sketch will get best results.

To make them, cut out two pieces of steel as indicated in the sketch. Cut two slots in the top piece for bolts



Left and center, mine truck built by United Verde company to carry concrete mixer. At right, the driving engine



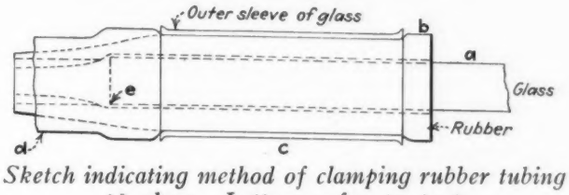
Details of wedges for leveling machines

to slide in and tap out the bottom piece to allow the bolts to screw into it. By bringing pressure on the head of bolt, the opposite end of the wedge, which is placed under the machine to be raised, may be forced up. Two dowel pins are placed in the center as indicated to hold the wedges in place. These should fit loosely in the bottom wedge. After the machine has been raised to the proper level, lead or cement can be poured under it, and when this has set, it is a simple matter to remove the wedges.

A Clamp for Rubber Tubing

IDEA No. 3

THE following method of clamping rubber tubing to glass tubing for general laboratory apparatus or for pressure or vacuum systems is described by H. W. Batchelor in the April issue of *Industrial and Engineering Chemistry*. A sleeve, *c*, approximately 1½ in. (3.8 cm.) long, may be made of thin glass tubing the inside diameter of which is only slightly larger than the outside diameter of the tubing to be used. The



Sketch indicating method of clamping rubber tubing to glass. Letters refer to text.

sleeve is first slipped several inches on the rubber tubing. The tubing is then slipped into place on the glass tubing, *a*. While holding both the glass and the rubber tubing at *b*, the latter is stretched slightly so that it assumes the position indicated by the dotted lines at *d*. The glass sleeve is then put in position and the rubber tubing worked back into position as shown by the heavy lines at *d*.

When the rubber tubing has been properly worked into position, the clamp is so effective that it is practically impossible to remove the tubing when pulling at *b*. By stretching the tubing again at *d* and removing the sleeve, the two tubes can be easily separated again. Though not usually necessary, the clamping effect may be increased by slightly widening the end of the glass tubing at *e*.

If the clamp is used in the construction of gas-analysis apparatus, a mercury seal would scarcely be necessary, as the rubber tube is clamped uniformly throughout its circumference. The clamp may be modified, however, to form a cup for a mercury seal at the right. A mercury seal to connect two rubber tubes can be easily prepared by welding a side arm at the mid-point of the sleeve. Such a cup can be used either with a straight side arm in a horizontal position or, if it seems desirable, in a vertical position with the side arm bent to a vertical position.

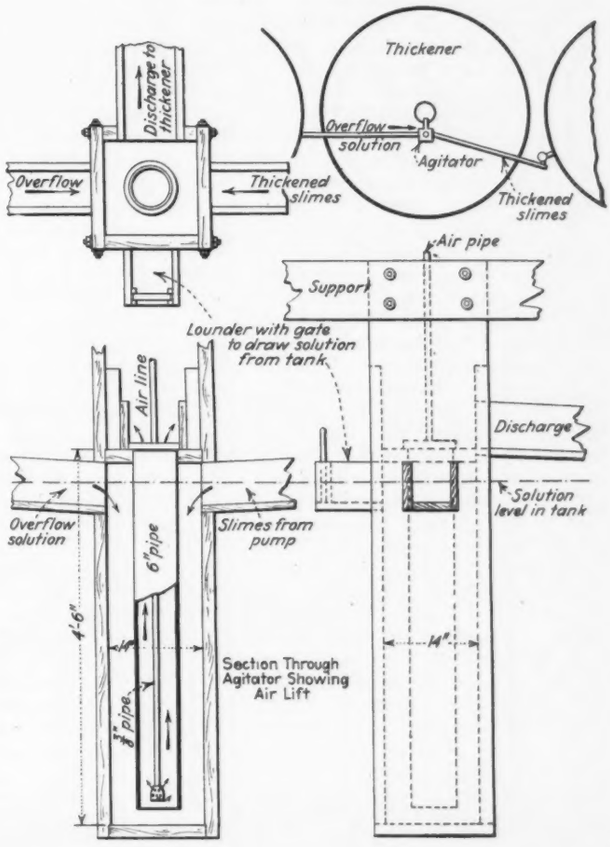
The sleeve also affords an excellent protection for the rubber tubing if it is necessary to wire it in position on a modern base. It is hoped to make available in the near future either metal or other tubes for this purpose.

Small Air Lift Insures Adequate Mixing of Pulp with Wash

IDEA No. 4

AT THE PLANT of the Wright-Hargreaves Mines, Ltd., at Kirkland Lake, Ont., it has been found desirable to adopt special means to effect an intimate mixture of pulp with wash in the countercurrent decantation plant. For this purpose a short air lift is provided in some of the Dorr thickeners, within the central baffled zone. The incoming thickened pulp and wash solution is delivered to this air lift and there thoroughly mixed. The illustration shows the details of construction of the air lift and the general arrangement of the apparatus.

Details of construction of air lift and manner of using it in thickener



case, why the use of the word "and" in my concluding sentence, before the quotation. A. SPENCER CRAGOE.

Liskeard, Cornwall.

[Our correspondent is insistent that his protest be published verbatim. If "argentiferous galena" was meant, however, should he not have said so? Other combinations of lead and silver are known, and no justification can be seen for the objection to the revised rendering. The obvious printshop error in the last paragraph is regretted, and apologies are offered.—EDITOR.]

* * *

Amalgamation of Gold

THE EDITOR:

Sir—The editorial rejoinder to my recent comments on the subject of the increased weight of rolled gold introduces some statements as regards the amalgamation of gold with which I cannot agree. It is quite true that when mercury "amalgamates" with gold "something more than adhesion occurs"; the mercury slowly diffuses into the gold, forming an intermetallic compound, but this is a relatively slow process, and the people who invented the term amalgamation to describe what happens when gold and mercury are put together were quite unaware of its occurrence. It was, so far as I know, never clearly described before the appearance of my paper in the American Institute of Mining and Metallurgical Engineers *Transactions*, Volume XXXVII, page 56 (1906). What the word amalgamation is usually used to describe, therefore, is a simple wetting process, just as the water wets a silver spoon when you dip it in your teacup. Mercury wets gold as freely as water wets silver, unless something else which mercury does not wet is already adherent to the gold surface, such as a film of grease. In the case I described, the scale, etc., was actually embedded in the soft gold by the hammer, and the operation which I described as "cleaning" with rouge was really a loosening and removal by rubbing, which I found I could do even more effectively with fine emery cloth than with rouge. The surface was not made smoother, because the rubbing was not continued to that point; it was distinctly rougher, as minute pits were left in which the foreign material had been embedded. In any case, the smoothness of the surface would have no effect on whether the mercury would wet it, except to increase the surface exposed.

The suggestion that rouge on the surface of the gold might "exert a mild catalytic action" is a defiance of physical chemistry. The rouge would be on the surface, the reaction between gold and mercury to form an intermetallic compound takes place after the gold diffuses through the surface, and there is no experimental evidence to support a hypothesis that rouge can diffuse into gold or that the rouge (Fe_2O_3) would exert any such effect if it did so diffuse. The suggestion is thrown out of court by the observed fact that the results were the same when the gold surface was cleaned with emery as when it was cleaned with rouge. Mercury easily wets a clean gold surface; it does not wet the surface when something else which mercury does not wet is adherent to the gold. T. T. READ.

Scarsdale, N. Y.

[Dr. Read's further comments on amalgamation are of interest. For the benefit of those of our readers who have not followed the discussion, however, it will be pertinent to point out that it originated in an inquiry as to the possibility that gold on exposure might adsorb sufficient moisture to affect precision weighing. The result, from the amalgamation point of view, of "cleaning" gold with rouge was then introduced by Dr. Read, whereupon we drew attention to the generally accepted conclusion among physicists that the operation resulted in the adsorption of the rouge on the gold, thus introducing another factor. The subject is of intense interest, but the precise explanation is apparently not available, and we would hesitate to dogmatize as to the mechanism or resultant of the alleged combination.—EDITOR.]

* * *

The Critical Temperature for Cracking Quartz

THE EDITOR:

Sir—The editorial in your issue of April 21 on "Modern Fire-Setting," reminds me of the articles on the effect of heat on rock in the January to May, 1927, *Bulletins* of the Institution of Mining and Metallurgy. The disintegrating effect of heat is there shown to be caused by the intermolecular change accompanying the inversion of alpha to beta quartz, which inversion takes place at or near 575 deg. C. If the rock is quenched when around this temperature, the strains set up in the quartz cause it to shatter, and the rock breaks easily.

Your editorial mentions temperatures of 1,000 to 1,500 deg. C. (presumably with subsequent quenching) as being employed recently in South Africa. Now, it is particularly emphasized in the above-noted *Bulletins* (that of February, p. 23) that the success of fire-setting may be expected to depend on quenching at or near the critical temperature of quartz. The fact is also mentioned that in ancient workings where fire-setting was practiced it has been observed that the early miners apparently took pains to build their fires sufficiently far back from the working face as not to calcine or unduly heat the rock. The interesting inference to be drawn from this is that the miners of long ago knew a lot more than they have been given credit for, and that they took advantage of the inversion temperature of quartz unconsciously, having observed that placing their fires close to the face did not yield as good results.

If the foregoing is correct, one may be permitted to feel curious as to what can be the purpose of employing the high temperatures mentioned in your editorial. HUGH S. SPENCE,

Mining Engineer, Department of Mines.

Ottawa, Ont.

* * *

On Corral Mercury Deposits

THE EDITOR:

Sir—Mr. W. E. Franks' letter in the issue of May 5 has amused and interested me, for I had a similar experience of a discovery of a supposed native mercury mine, which, though at a place thousands of miles from Altamira, owed its deposition to the same source and similar causes.

While resident in Cordoba, Spain, I was one day offered a mercury mine for denouncement. The discoverer was somewhat mysterious as to its locality at first, but ultimately said it was not far away, and undertook to show it to me. He then took me to an old corral just outside the city walls near the entrance of the road from the Almaden mine, which—writing from memory—is a hundred miles or so to the northeast.

In the days to which Mr. Franks refers, all the mercury for the new continent passed through Cordoba to Sevilla for shipment, and this corral would be a likely place for the packs to be unloaded, for a night's rest. Someone had noticed beads of mercury in the hardened dirt, and fancied he had found a new Almaden at the city gates!

This reminds me of another offer, of a copper mine. Samples were brought to me of copper pyrites mixed with a little gangue, with the usual mystery as to its locality. I examined it and remarked that it must have come from a very shallow depth—between two and three meters from the surface, judging from the signs of partial decomposition. Later, I learned that it had been found in a small excavation close to the old walls on another side of the city. Sometime afterward I was highly amused to hear that my reputation had been greatly enhanced by the fact that I had been able to tell from the sample the exact depth at which it had been found.

At a distance of 10 miles on the road to Almaden there were some copper mines famous in the days of the Romans, who worked them extensively. When told where the ore had been found I had no doubt that it came from those mines and had been left there by the ancient miners.

On another occasion, while visiting one of the cuprous pyrites mines being worked by my company in the Province of Huelva, a stranger brought me a sample of pyrites from a place he wished to show me many miles from there, and in a district I knew to be outside the mineral belt. I looked at the sample carefully and recognized it as being from our own mine. I asked the foreman if he knew this man, and he said he was a bad character belonging to the neighboring village, and was in fact a

COMMENT AND CRITICISM

An Engineer and His Patents

THE EDITOR:

Sir—The matter of patents is one of the most important considerations of modern industry. It is of particular interest to engineers, because engineers are the most prolific inventors. The Heywood and Carson cases mentioned by Hiram W. Hixon in the issue of May 12 bring up points of interest, and the discussion on "Xanthate and Minerals Separation" brings up others. A free discussion of patents and inventions would no doubt result in some good.

In the case of the Heywood and Carson inventions, the difference probably lies in the assumption that Heywood may not have got his invention patented and Carson did. If Heywood patented his invention—and his process is essentially the same as that of Peirce-Smith—there can be no doubt that a gross miscarriage of justice occurred somewhere. Commercial use is not a condition of a patent grant nor in maintaining its validity after the grant. It is only of importance in a controversy between two inventors. If an inventor fails to get his invention patented, and the invention is later brought into question, that is his misfortune. If the process invented by Heywood had continued in operation, or if he had put it on public record, as in a patent, the decision in both cases should manifestly have been the same.

If the invention of a meritorious inventor could be declared invalid because someone, sometime, somewhere, did something like it, few patents would be worth the patent fee. All kinds of faked testimony would be presented, as well as genuine evidence, and neither the judge nor the victim could distinguish between the fake and the genuine. It is rather curious, too, that those who want justice are frequently those who do not render justice. Some of the very patent exploiting companies which object to having their patents invalidated on the basis of unpatented or unpublished work of others, invoke the same kind of testimony to invalidate or cloud the patents of others. The ordinary inventor, who usually depends largely upon his professional income to exploit his ideas, is in no financial position to defend his patents against a large patent exploiting company, with its staff of legal experts, most of whom are honest and are inclined to be fair, but many of whom are unfair, and some of whom are unscrupulous and some downright crooks. Few inventors are in a position to litigate for years, and there is no justice for them, even assuming that the judges are competent and honest. In a fight between a giant and a dwarf, the dwarf usually gets licked, no matter how impartial the rules of the fight may be.

It is gratifying to note, on the other hand, that many companies appreciate the value of inventors. A member of the patent staff of one of the largest metallurgical companies in the United States told the writer a few years ago that his company, through its patent staff, was inclined to give the inventor the benefit of the doubt if the inventor presented something of use to the company and if he was reasonable in his demands. If all companies pursued such a course there would be little complaint from the inventors.

In these days of large enterprises, involving large capital, it is usually out of the question for an inventor to put his invention in continuous commercial operation. This is especially true of metallurgical patents, since thousands and sometimes millions of dollars are necessary to conduct a metallurgical enterprise. Even if the enterprise is started, it may fail through no fault of the invention. A new and highly superior process can hardly ever compete in its first stages with a highly developed inferior process.

Usually, when an inventor makes a meritorious invention and takes out a patent, he can figure on years of litigation. After the litigation a few years are left for commercial exploitation. By the time that is done, and he can visualize a going concern, the seventeen years of the patent have expired and his work and his expenditures are confiscated. This is usually considered eminently just. If an inventor has made himself poor in giving his ideas practical application, that does not concern the government. A government has no heart and it has no soul. Not the pittance of a pension, even in cases of extreme destitution, is ever given to the widow or children of a meritorious inventor, who is frequently deprived of his intellectual property before death, and no provision is ever made to compensate him for his expenditures.

The law is heartless, merciless, remorseless. Yet, on the other hand, to the heir who does not earn his material property, to the profiteer who gets it by unfair means, and even to the thief who steals it under the shadow of legality, the law says, "Your unearned and your ill-gotten wealth is sacred; it may belong to you and to your heirs forever, and your heirs may forever have the right, to the extent of your wealth, to bring unborn generations under their bondage."

It takes as much brains to discover and develop a meritorious invention as it does to accumulate a fortune, yet we are told by the American Taxpayers' League, with its galaxy of illustrious names, that even the present small federal inheritance tax is confiscatory and socialistic. The League is silent about the confiscation of the intellectual property of inventors, authors, composers, and scientists, even during the lifetime of their possessors. Apparently it assumes that the sin of invention of a father is justly visited upon his widow and children.

Manifestly, some of our American institutions are hideously unfair. If American ideals are to survive, a broader justice is imperative. Anti-trust laws have proved a failure in the effort to establish a satisfactory relation between individuals and big business, and justly so. The progress of civilization cannot be turned backward. Big business has come to stay, and it is going to be bigger. The right solution of the trust problem is not through corporations but through individuals. Politicians and economists are failing in their efforts to harmonize the new relation between the individual and big business. The engineers might do better. It is not likely that they would do worse. WILLIAM E. GREENAWALT.

Denver, Colo.

* * *

Cornish Mining, Geophysics and Psychics

THE EDITOR:

Sir—As my letter under this Caption published in your issue of March 31st was rather a lengthy one, I take no exception to your having somewhat revised it. I feel, however, that this revision is not up to the standard that one expects from your esteemed journal and, anyhow, I must say that you have made me use very "stilted" language, and caused me to be guilty of at least two glaring "bloomers." The beginning of the second line of the fourth paragraph of the first Column should not, for instance, read "Silver, Lead," etc, as printed, but "Silver-Lead" hyphened —Argentiferous Galena. In the second

Amalgamated Copper Company, then in its infancy, and which later was destined to become the nucleus of the present Anaconda Copper Mining Company.

Mr. Lawson was active in the initial flotation of Amalgamated Copper Company shares, which had been formed by the late H. R. Rogers of the so-called "Standard Oil Group" in Montana. Differences of opinion took Lawson outside the fold, and the Trinity Copper Company later was organized, for the avowed purpose of "combating the octopus." It proved to be nothing more than a market medium and not, it was recalled today, a very successful one.

* * *

The Oil Smear

ACQUITTAL in such a notorious case as that in which Sinclair was involved does not mean restoration to public confidence or respect. A larger jury has already brought in its verdict. Mr. Sinclair stands legally quit of the crime of conspiracy, but on the moral counts of his indictment the general judgment has gone heavily against him. From that no appeal lies. He is condemned to figure as a man of great wealth who had snapped his fingers at its just and unescapable responsibilities. He tampered with one whom the Supreme Court has declared to be a "faithless officer" of the government. He sought to cover up his tracks by the lavish use of money, personally and politically. That record cannot be altered. Nothing that happened in his criminal trial at Washington can change it. He will remain a scandal to his class; a public warning to rich men, tempted as he was, to avoid his example as they would the plague. For both him and ex-Secretary Fall the sentence of the intelligent public has been pronounced and will abide.—*New York Times.*

* * *

Co-operation at Its Zenith in the Tri-State District

KARL MARX originated the theory of the combat of labor and capital. Similarly one often hears of strife between various phases of industry. Agriculture and mining, as two of the most elemental of man's occupations, have not infrequently come into conflict. In our current issue we publish an article by James D. Stewart portraying such a rivalry growing out of the restriction of hydraulic mining in California. Amid this cruel and often unnecessary dissonance it is reassuring to hear a note of harmony. Our Tri-State correspondent writes and we read, with equal pleasure, "Most of the 3,000 unemployed miners in the Joplin-Miami district can be found among the 60,000 strawberry pickers harvesting the crop in the southwest Missouri and northeast Arkansas fruit belt. Much of the mine labor of the district has been recruited from the farming areas adjacent to the mining field, so many of the erstwhile farmers are back at their original vocation."

Consultation

Iron-Ore Royalties

"Can you give me any information on the royalties paid by the operators, working under lease, the iron-ore lands of the Great Lakes and other districts? Do these royalty rates vary in different localities? If so, what is a fair rate, and what are the factors that influence the variations in rates? Is there a tendency toward lower rates at the present time?"

According to the best information at hand, royalties on iron ore, as mined by operators working under leases, do vary, and materially. When the State of Minnesota entered the business of leasing ore lands, it established a rate of 25c. per ton, and almost all its lands are leased at that rate. Recently the rate has been changed, however, and now state leases are given on competitive bids. When the Great Northern Railroad Company began to lease the lands returned to it by the U. S. Steel Corporation in 1915, it established a basis for royalties at from 85c. to $1 per ton. The Minnesota and Great Northern figures indicate closely the extremes, although a few leases have been arranged on a per-ton basis of greater than $1, and a few at less than 25c. In Michigan the rates are commonly based on a sliding scale, depending on the price of ore, though in some districts of the state the rates are at a fixed basis, which in some instances is as low as 10c. or 15c. per ton. Southern "red" ores fetch lower royalties on the average than Lake ores, the probable explanation being that reserves, compared with consumption, are appreciably greater in the South than on the Lake. In the final analysis, royalty rates depend on two main factors—grade and ease of mining. An operator can better afford to pay $1 on some ores than 25c. on others, both being marketable. Available tonnage is a factor, also; transportation costs are important in some localities. But no set rule governs the royalty rate; it is a matter of negotiation. The present tendency is toward a lower rate than was prevalent a few years ago, and royalty negotiations will always be influenced by the price of ore and general conditions of the iron ore market.

* * *

Depletion Allowance for Income-Tax Returns

"I have a copper mine here in New Mexico which has developed from a prospect to a mine of considerable tonnage in the past three years and is shipping about 1,000 tons per month. It has reached the point where I should put in a claim in my income tax for depletion.

"Sometime ago I heard that the Treasury Department or Congress had in mind changing this depletion system and allow 15 per cent of gross output for depletion. Can you advise as to present status of this plan and how it will effect the discovery value claim?"

The income tax bill which recently passed Congress and became law makes no essential change in the depletion provisions of the 1926 act. Though the provisions are rewritten, and any rewriting of a law may introduce certain minor variations, the intention of the Treasury Department and of Congress is simply to continue in the new act the now existing provisions.

Specifically there is no provision in the new act for percentage depletion. Discovery provisions continue as heretofore, and there is no change in the depletion provisions of the former act.

There is no reason to anticipate any radical change in departmental procedure, so we think it can safely be said that the only way in which one having a discovery can get any depletion currently allowable is by the same procedure as has heretofore existed. Perhaps the hope is warranted that the department will in the future be less insistent on technicalities and more concerned with the facts than it has in some cases in the past, but this would not in any way change the fact that the taxpayer would have to prepare and present his claim under the present bill in substantially the same manner and subject to substantially the same procedure as has been in effect heretofore under the previous act.

* * *

Flotation of Copper-Zinc Sulphide Ores

"Can you give me any information as to the details of approved methods of treating, by flotation, a copper-zinc ore in a massive pyrite gangue? An average analysis of the ore is 2.0 per cent copper, 7.0 per cent zinc, 38 per cent iron, 47 per cent sulphur, and 5 per cent 'insoluble.'"

The flotation of an ore is largely a problem for individual consideration, the solution of which depends on many local factors. However, details are available concerning the treatment of an ore of somewhat similar analysis to the one you describe, and in which you may find something of interest. The ore is crushed to ¼ in. before ball milling, and is ground to 75 per cent minus 200 mesh. Lime is added ahead of the ball mill and a faint alkalinity maintained during the copper flotation step. Pine oil, xanthate, and zinc sulphate are added just ahead of the copper cells. Aërofloat may replace the pine oil and xanthate. The copper tailing is conditioned with copper sulphate, and higher lime alkalinity is maintained than in the copper flotation. After conditioning, xanthate is added and a zinc concentrate secured. The copper concentrate assays 20 per cent copper, 2 per cent insoluble, and 4 per cent zinc. Great difficulty has been experienced in securing a sufficiently high zinc recovery, but it is reported to average 85 per cent at the plant we have in mind.

bandit who had committed many crimes. Shortly after he was shot by the Guardia Civil. No doubt his motive was to entice me to accompany him to a lonely place and rob me!

RICHARD E. CARR.

London, England.

* * *

Geophysical Directory

THE EDITOR:

Sir—*Engineering and Mining Journal* of March 24, 1928, gives a list of geophysical exploration companies and manufacturers of geophysical apparatus. I note that this fails to include the firm of Piepmeyer & Company, Rasenallee 13, Kassel-Wilhelmshoehe, Germany, and also that of its representative in the United States, the Electrical Prospecting Corporation of America, branch office, 2305 Esperon Building, Houston, Tex.

The apparatus used by Piepmeyer & Company for electrical investigation is manufactured in that company's shops in Germany, for the exclusive use of its European and overseas branches, and is not for sale.

Will you, therefore, include the name of Piepmeyer & Company (Elbof Department) in your list?

AUGUST E. BORSUM.

Houston, Tex.

Diamond Prices Secure

South African Government "Conspires" With Industry to Prevent Disorganization

THE EDITOR:

Sir—Ever since the news of the discovery of fresh diamond fields in South Africa, a drop in diamond prices has been predicted. No justification exists for this conclusion. The assurance that prices will be maintained was secured in a recent interview in London with Sir Ernest Oppenheimer, whose judgment on the marketing of diamonds is unquestioned.

There is no danger of a reduction in diamond prices through overproduction, he said. A system developed by the London Diamond Syndicate and the South African mine owners and governmental authorities keeps the output strictly within demand. The new diamond syndicate was organized in London in 1925, when production of diamonds was chiefly in the hands of the De Beers, New Jagersfontein, Premier, and Consolidated. With these companies the syndicate concluded voluntary sales agreements extending over many years, and at the same time it kept a watchful eye on the alluvial fields on the river and on the diamond fields in British Guiana. In this way it found itself, by 1926, in a position to control virtually the entire diamond output of the world.

Then, suddenly, the situation changed with the discovery of alluvial diamonds in the Lichtenburg district, with the result that extra diamonds worth $30,000,000 entered the market. This unchecked exploitation of the new fields led to a drop in prices. It was impossible for the syndicate to deal with so many small mine owners, and for the time being the situation was extremely grave. Then relief came from another quarter.

The South African government decided to bring in the Precious Stones Bill, by which it secured for itself the right to limit production. As a result of that measure, production is now so regulated in the Lichtenburg district that danger no longer threatens the diamond industry from that quarter.

As a further safeguard, the syndicate caused a geological survey of the Lichtenburg district to be made; and, acting on the advice of a well-known geologist, it has acquired several farms on which in all probability diamonds exist. No prospecting is taking place on these farms, which will remain closed indefinitely. Should they be thrown open in the future, they will naturally be worked in agreement with the general policy of the government and of the syndicate. In short, the Lichtenburg district has ceased to be a menace, according to Sir Ernest, who then discussed the newly discovered fields in Namaqualand.

Here the situation is very different from that which occurred at Lichtenburg, he pointed out. First of all, it should be understood that most of the stones found here are of large size, weighing up to 10 carats and more, which are greatly in demand, especially in America. These stones are found in isolated pockets. The Merensky fields are the richest in Namaqualand, but the area where the stones lie is limited, having an average width of about 30 ft., a length of 3,000 ft., and being comparatively shallow. The most optimistic estimates state that there are about 600,000 carats in this area, whereas others place the quantity as low as 366,000 carats. In any case, such quantities can be readily absorbed by the diamond trade. Whatever the wealth of the Namaqualand diamond fields, the influence is secondary compared to the fact that a systematic control of the output has been assured.

The fields to the north of Port Nolloth belong to the state, which is not likely to deviate from its own policy of limitation. The fields to the south of Port Nolloth are in the hands of the Cape Coast Exploration Company, which is in close touch with the Diamond Syndicate. Hence, the situation in Namaqualand is completely in the hands of those who recognize the need for a rational economic exploitation of these stones, according to Sir Ernest, who was asked if the market would be affected in the event of further discoveries of diamond fields in Africa.

"Not as the situation stands now," he replied. "In the first place, the South African government has forbidden all new prospecting for twelve months. And, in the case of new discoveries, the government policy of 'limitation in proportion to demand' will be systematically carried out, so that any flooding of the market, such as was brought about by the rush to the Lichtenburg district, need no longer be feared." F. A. COLLINS

New York, N. Y.

[Restriction of output; the roping off of promising areas; making prospecting illegal—these are some of the drastic methods being used by the diamond industry, in co-operation with the South African government, to prevent price disorganization. As the U. S. Department of Justice is said to be considering the confiscation of imported asbestos produced under group control in Canada, one may wonder if the autocratic methods of the diamond producers, backed and encouraged by the authorities, will meet with similar disfavor in this country.—EDITOR.]

READERS of E.&M.J. are respectfully asked not to send in anonymous communications. Unless letters to the editor can be identified and their import, if there be any, made a matter of record, they will not be published. The writer's identity will be suppressed, if the request to do so be made, but the name and address of the correspondent must always be incorporated if he desires his comments to be read and published.

By the Way

Famous Trinity Copper on Bargain Counter

SHADES of Tom Lawson! The one-time plaything of the late Boston financier—the Trinity copper mine—was offered for sale recently in an inconspicuous single-column advertisement, measuring thirty agate lines, says the New York *Evening Post*. Under the heading "Copper Property for Sale" appeared a brief description to this effect: "The celebrated Trinity mine, located in the Town of Kennett, Shasta County, Cal., consisting of about 488 acres of subdivided land, 330 acres of placer ground, fifty-nine patented lode mining claims, together with valuable water rights, cabins, buildings, equipment, etc. This property adjoins the well-known Mammoth mine of the United States Mining Company. The property can be purchased at a very low price and on favorable terms."

To those denizens of Wall Street and State Street, Boston, familiar with happenings of a generation ago the Trinity Copper Company today conjured up a quiet laugh, for, be it remembered, continues the *Post*, it was with this vehicle that Tom Lawson, then widely known throughout the financial world, had threatened the very foundations of the

INDUSTRIAL PROGRESS

Copper Brazing Proves Practicable in a Hydrogen Atmosphere

PRACTICAL difficulties involved in brazing with copper, so as to secure a perfect alloy weld between surfaces that could be united only with difficulty by any other method, have recently been overcome by the engineers of the General Electric Company through perfecting a design of electric furnace in which an atmosphere of hydrogen can be maintained at will. The presence of hydrogen in the furnace cleans the metals to be brazed and not only obviates the necessity of any flux but also insures the flowing of the copper used in brazing into the joints to be united. Nor is this all. The capillary attraction draws the fluid copper into the smallest crevice of the joints and produces a solid union between the various pieces. The story is told in a recent issue of *American Machinist*. Development work has been under way for several years in the General Electric laboratories.

Fig. 1—Left, steel plates assembled to form a steam table, with copper wire for the joints. Right, the completed job after brazing

Special furnaces are required for the economical use of this method; otherwise it would be necessary to inclose the work in special containers into which hydrogen could be introduced. A typical hydrogen brazing furnace used in the Schenectady plant of the company consists of three "stages." Each stage is in the form of a platform, the three mounted on a turntable. Covers which may be raised and lowered are provided for two of the stages. The work to be brazed is first assembled on one stage, copper wire or chips being placed adjacent to the joints to be united. After the cover is lowered over the work, the furnace is heated to about 1,100 deg. C, or 2,012 deg. F. Hydrogen, being lighter than air, remains in the cover while it is raised. This melts the copper that has been placed on the work near the joints and it flows into each joint and over the work itself near the joints. The entire surface can be covered with copper should it be desirable to do so.

When the copper has been melted the covers are again lifted and the turntable is moved to bring the brazed work under the cooling cover, and a new batch moves into the furnace. The cooling furnace or cover also contains hydrogen, but is surrounded with water pipes so as to cool the work to atmospheric temperature. The hydrogen prevents the formation of oxides during the cooling process. A continuous type of furnace has also been developed.

It is difficult to realize how thoroughly the melted copper flows into the smallest crevice, and the example in Fig. 1 is of particular interest on that account. Here are a number of ground-steel plates to form a steam table. The various parts are laid on the base plate and tracked by arc welding to hold them in place. The holes are drilled and all the plates riveted together. Then the copper wire for the joints is laid into the recesses as shown and the whole thing put into the special furnace. When the proper temperature is reached, the copper flows into every joint and between adjacent flat surfaces. In the riveted joints the copper fills any minute opening between the rivet and the plates and so produces a perfectly tight joint as well as giving 100 per cent joining of the metals.

The process of copper brazing in a hydrogen atmosphere is a striking example of what can be accomplished by the co-operation of chemical, electrical, and mechanical engineering. Without the electric furnace, as now developed, the practical applications of this method would not be available to the manufacturer. Possibilities of such applications are almost endless.

The Equipment Review

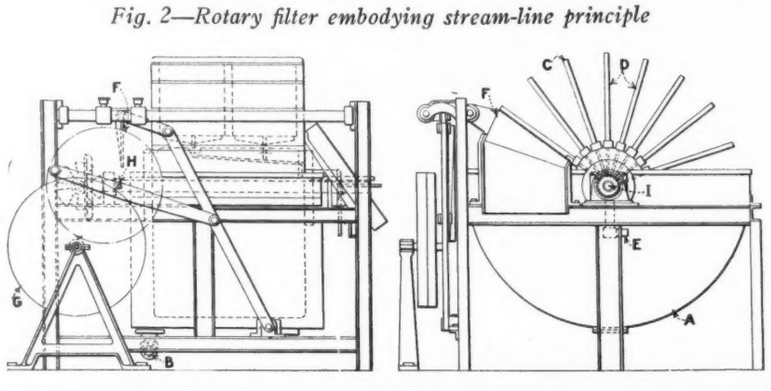
Equipment of a varied sort and some useful devices have been recently introduced for mining and metallurgical purposes. Among them the following will be found of interest:

Filtering

The principle of stream-line filtration, which was discussed editorially in the issue of May 21, is the basis of the rotary filter shown in Fig. 2. This filter is the invention of Dr. H. S. Hele-Shaw, and Messrs. R. C. B. Stillman and J. A. Pickard, all of England. The cycle of operations includes filtering, washing, drying, loosening the cake by compressed air, and, finally, its removal by means of longitudinally traversing scrapers.

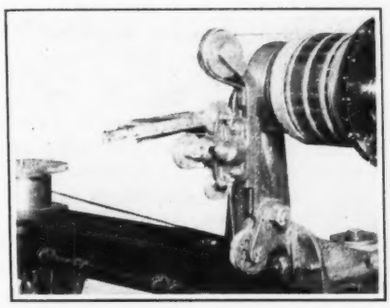
In Fig. 2, *A* is the casing containing the pulp. In this rotate a series of filter units, *C*, mounted as shown. Each of these units has two oppositely disposed parallel filtering surfaces, *D*, between which are arranged passages leading into the drum which carries the units. The scrapers which remove the cake are shown at *F*. These are wedge-shaped so as to operate on the surfaces of two adjacent units at the same time.

Fig. 2—Rotary filter embodying stream-line principle



Adequate mechanism is provided to accomplish the rotation of the filter unit through the various phases of the cycle, as well as the oscillating movements of the scrapers. This filter is covered by U. S. patent No. 1,666,381.

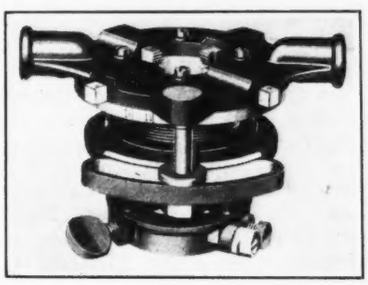
Binding Armatures — An ingenious device for use when repairing haulage motor armatures has been developed by the General Electric Company. It is shown in the accompanying illustration. It will indicate the exact strain or tension in pounds that is applied to the steel binding wire by the binding machine or lathe, thus permitting the tension to be controlled when binding up an armature. Constant tension can thus be maintained at all loads, which will prevent the wires from loosening. The indicator can be applied to practically any type of armature-binding machine.



Device maintains tension of wire in binding armatures

Shop

Pipe Threading—Two new and improved die stocks are introduced by the Borden Company, of Warren, Ohio. They are self-contained and adjustable and 1 to 2 in. in size. One is known as the No. 11 Beaver plain tool and the other No. 11A Beaver ratchet. These supersede the old Nos. 25 and 26 respectively. The stocks are lighter in weight, more easily worked, and more simply made. With them one set of dies is quickly set to thread 1, 1¼, 1½, or 2 in. without changing.

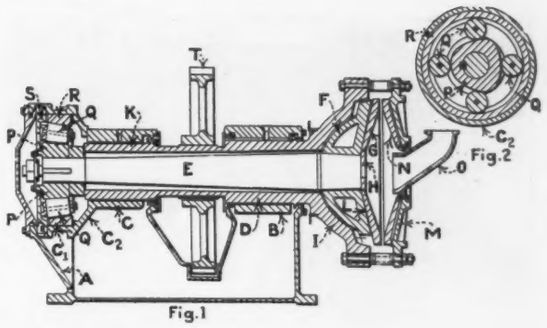


Improved die stock recently introduced

Grinding

The American Pulverizer Company, 1249 Macklind Ave., St. Louis, Mo., has recently been granted a patent (U. S. No. 1,666,124) covering a centrifugal mill, which is similar in construction to the company's so-called American rolling ring crusher. Crushing is effected by manganese rings which strike the material to be ground while it is in suspension, the material then falling to a concave grinding plate and grate bars for final pulverization. This crusher is used for grinding all kinds of refractory material.

Fig. 3 The eccentric motion of the crusher plates in this machine is developed in a novel way



Another crusher, which has been patented by J. A. Dormer and J. G. Malone, of Detroit, but which so far as known is not yet in production, is shown in Fig. 3. It is covered by patent No. 1,666,530. The material to be crushed is deposited between a pair of spaced conical plates, or surfaces, arranged to rotate together, one of the plates being capable of a tilting movement with respect to the other. An object of the invention is to eliminate the undesirable friction accompanying the use of eccentrics to tilt the tilting-plate shaft, by the use of rollers engaging a cam carried on the end of the tilting shaft. The ring cam, *P*, develops a multiplicity of eccentric throws per single revolution of the crusher plates. By varying the number of rollers, *Q*, the number of relative tiltings of the plates may be increased or diminished as desired. The two conical plates are shown at *G* and *N*. Ore is fed into the space between the crushing plates through the chute *O*. The hollow shaft, *D*, contains within it a tapered shaft, *E*, the forward end of which carries a spherical crusher head, upon the surface of which the crushing plate, *G*, is secured.

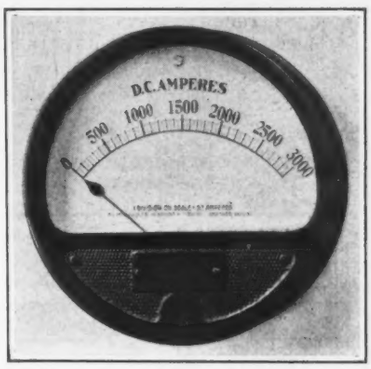
Switches

Knife Switches — Westinghouse has announced a new line of switches. These are of the Type BB back-of-board knife variety. The switches are particularly adapted for industrial control auxiliaries. They have been designed to improve the safety of switching operations of the low voltage class; and are made for 250 volts d.c. and 500 volts a.c. and for capacities ranging from 30 to 800 amp. They may be obtained in one-, two-, three- or four-pole units.

Drum Switches—General Electric has also announced a new line of primary resistance drum switches for use with squirrel-cage induction motors on small cranes, hoists, machine tools, and the like. This switch is designated CR-3200-1250. It is a primary reversing switch designed for operation on maximum primary voltages of 550. Maximum horsepower rating for two- or three-phase service is 15.

Instruments

Ammeters, Voltmeters—Westinghouse has also introduced a line of SX ammeters and voltmeters of the marine type intended for use in mines or wherever damp conditions exist. They operate on the D'Arsonval principle. The voltmeters have a range of 150 to 750 volts and the ammeters are from 50 to 8,000 amp. One of the ammeters is shown in the accompanying illustration.



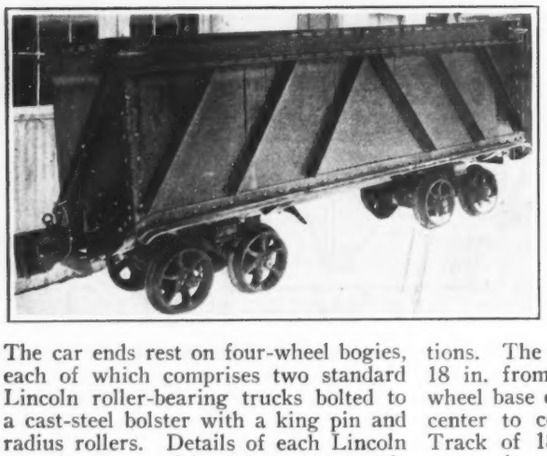
A new ammeter of the marine type

Park Utah Adopts Ore Car of New Design

BY REPLACING ore cars of 20 cu.ft. capacity and weighing 1,000 lb. with miniature railroad-type cars of its own design and of a capacity of 68 cu.ft. and 3,450 lb. weight, the Park Utah Consolidated Mines Company, Park City, Utah, recently doubled the ore-haulage capacity of its Ontario tunnel. At the same time it made operations in the tunnel much safer and effected a reduction in labor costs per ton of ore transported.

The new equipment, which was manufactured at the company's Park City shop, is used on a 10,000-ft. haul extending from the loading pockets at the top of No. 2 shaft of the Utah unit to an ore tipple along the Union Pacific railroad tracks at Keetley, Utah. The tunnel is of small cross-section, and for this reason it was necessary to limit the over-all width of the cars to 3 ft. The car is designed for a minimum radius of curvature of 21 ft.

In keeping with railroad practice, the bottom of the car is solid steel, and the entire car weight is supported on the axle bearings, no springs being used.



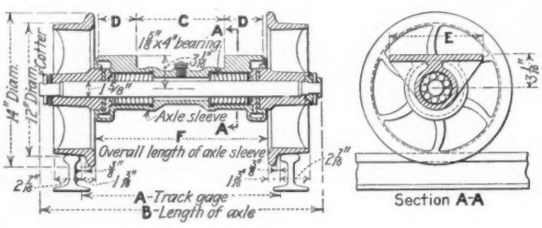
One of the new ore cars used in the Ontario tunnel of Park Utah Consolidated Mines Company

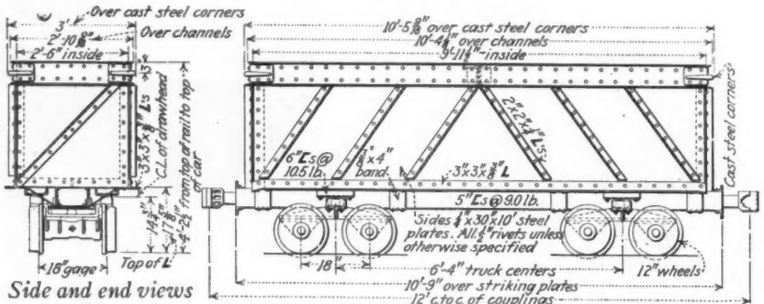
The car ends rest on four-wheel bogies, each of which comprises two standard Lincoln roller-bearing trucks bolted to a cast-steel bolster with a king pin and radius rollers. Details of each Lincoln unit include a 2-in. high-carbon axle (300 Brinell test), Hyatt roller bearing between the two wheels, and a grease-tight housing. The drawhead springs are set in a heavy longitudinal girder supporting the car body. Half-size M.C.B. couplings are used, with swivel draw bars of special design, permitting complete rotation of the car without uncoupling. This feature was provided because a Wellman-Seaver-Morgan car tipple is used in the unloading operations. The wheel base of the trucks is 18 in. from center to center, and the wheel base of the car is 6 ft. 4 in. from center to center of the swivel trucks. Track of 18 in. gage and 40 lb. rail are used.

With the 20-cu.ft. 1,000-lb. cars used previously, a train consisted of 35 cars containing 35 tons of ore. The new equipment moves 70 tons per train of 17 cars, and the train haulage time is less, as the heavier equipment permits faster travel. This change in equipment has, therefore, enabled the company to move more than twice the tonnage of ore in the same time, 1,000 tons being handled in a single shift.

Details of Park-Utah company's new mine car

Truck of car





Side and end views of car

PATENTS

ZINC METALLURGY. No. 1,669,406. May 15, 1928. H. G. S. Anderson, Rolla, Mo.

Process of recovering zinc from zinc sulphide-bearing material by heating the material in finely divided condition with finely divided iron to a sufficient temperature to volatilize the zinc contained and thereby separate it.

CENTRIFUGAL AMALGAMATOR. No. 1,669,430. May 15, 1928. Russell Thayer, Philadelphia. Filed May 1, 1922.

ROCK DRILL MOUNTING. No. 1,669,466. May 15, 1928. C. C. Hansen, assignor to Ingersoll-Rand Company.

FLOTATION. No. 1,670,021. May 15, 1928. Louis F. Clark, assignor to Union Carbide Sales Company, New York.

A method of treating ores containing copper minerals to increase their susceptibility to flotation concentration by processes dependent upon affinity between minerals and a gaseous agent which consists in applying acetylene and other oxidizable substances to the pulp so as to produce on the minerals a coating of cuprous acetylide and of the insoluble oxidation products.

SHOVELING MACHINE. No. 1,669,688. May 15, 1928. Frank H. Armstrong, Green Bay, Wis.

ROASTING FURNACE. No. 1,669,925. May 15, 1928. Dudley Baird, assignor to Nichols Copper Company, New York.

ZINC METALLURGY. No. 1,670,169. May 15, 1928. James A. Singmaster, F. G. Breyer, and E. H. Bunce, assignors to New Jersey Zinc Company, New York.

An improvement in the process of making zinc oxide.

INDUSTRIAL NOTES

Rollway Bearing Company, Inc., Syracuse, New York, has announced the appointment of Alfred E. Muhch, Jr., as representative in the Chicago-Milwaukee District, with headquarters at 544 Railway Exchange Building, Chicago.

The Hydraulic Pressed Steel Company, Cleveland, has been purchased by the Truscon Steel Company, Youngstown, Ohio, and will be operated as the latter's pressed-steel division.

The Celite Company, Los Angeles, has purchased plant and property of the National Magnesia Manufacturing Company at Redwood City, Calif. The business of the latter will continue under the name of the National Magnesia Company. The work at Redwood City includes the manufacture of magnesia, asbestos, and diatomite materials.

The American Lead Pencil Company has moved its general offices from 220 Fifth Ave., New York, to 500 Willow Ave., Hoboken, N. J.

Hans J. Meyer has been appointed an engineer of the foreign department of the International Combustion Engineering Corporation. He will sail on June 6 for the Far East.

E. J. Longyear Company, of Marquette, Mich., manufacturer of diamond core drills and supplies, recently opened a Canadian branch at Haileybury, Ontario.

Charles H. Jackson, formerly chief engineer of the Bayley Blower Company, Milwaukee, is now general sales engineer for the company. He is succeeded as chief engineer by Ernest Szekely.

H. K. Porter Company, Pittsburgh, has moved its Chicago office from 447 Monadnock Building to the New Engineering Building, Wells St. and Wacker Drive. George Kirtley continues as district manager.

Allis-Chalmers Manufacturing Company has moved its branch office at Grand Rapids, Mich., to 310 Building and Loan Building. G. C. Culver is in charge.

E. D. Pike has been appointed manager of the San Francisco branch sales office of the Wagner Electric Corporation. Mr. Pike has been with the company 26 years.

Splitdorf-Bethlehem Electrical Company displayed a highly diversified line of its products at the convention of the National Electric Light Association at Atlantic City June 4 to 8.

Kennedy Valve Manufacturing Company, Elmira, N. Y., has announced the election of Mathew E. Kennedy as president and treasurer, J. Carroll Kennedy, vice-president and secretary, and Clarence H. Kennedy as vice-president and general sales manager.

Manganese Steel Forge Company, Philadelphia, has moved its Chicago office from the Old Colony Building to the Builders Building, La Salle St. and Wacker Drive.

NEWS OF THE WEEK

Summary

THE SPANISH government has denounced the Rio Tinto company for understating the copper content of its export ore. Sir Auckland Geddes, chairman of the Rio Tinto board, has signified his desire to cooperate in the investigation. Page 950.

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A minimum of twenty electric locomotives to be used on the benches will make Utah Copper's Bingham mine the largest electrified metal mine in the world. Page 947.

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Newmont Mining has taken an option on the United Verde Extension properties at Jerome. Page 946.

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During the session just ended the Mexican Congress failed to take any action on the proposed labor legislation. The question will in all probability be brought before the next session. Page 950.

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Exploratory work is being undertaken on the Carp Lake copper properties in the Porcupine Mountains of Michigan. Calumet & Hecla is building a second smelting unit. Page 946.

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American Smelting & Refining has just acquired a controlling interest in the Silver Reef property, Washington County, Utah. Page 949.

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Court of Appeals upheld the Carson claims in the suit against Anaconda Copper in a decision made public May 29. Justice Dietrich dissented. Page 948.

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Southwestern Engineering is building a 100-ton cyanide mill for Siscoe Gold in the Quebec gold area. Contract calls for completion by November. Page 946.

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Ground has been broken for the 300-ton mill being built at Jerome, Ariz., for Verde Central. Page 949.

Sudbury Basin Mines Acquires Nickel-Copper Claims in Sudbury Area

Errington Mine and Creighton-Fairbanks Make Encouraging Discoveries of Copper-Zinc Ore—New Orebody at Flin Flon, to Southwest of Main Body, Appears Important

OFFICERS of Sudbury Basin Mines have for some time been acquiring groups of nickel-copper properties in the Sudbury district. Some of these properties have been developed almost to the mine stage. It is understood that a new company will be formed. Sudbury Basin will probably retain about 50 per cent of the stock in its treasury, and will offer its shareholders rights. The management hopes to develop Sudbury Basin gradually into a large exploratory and holding concern. This company also controls the Cheney copper property, which is now being developed. Surface trenching indicates a length of 3,000 ft. on the vein. On the 150 level a length of 200 ft. has been opened, which has an average width of 8 ft. Sinking on the Sudbury Basin property, where diamond drilling has definitely proved a length of 500 to 600 ft. of ore and partly proved a length of 3,000 ft., will probably be started soon.

In a crosscut on the 500 level of the No. 2 shaft of the Errington mine, 18 ft. of ore was recently encountered. This marks the discovery of a new orebody. The same crosscut is now advancing toward two diamond-drill intersections, one of which showed a width of 104 ft. and the other 34 ft. Developments at this property are continuing according to expectations. The mill, which was recently started, is handling 125 tons a day and is making 89 per cent recovery on the zinc and obtaining a 47 per cent concentrate. Results on the copper have not been as satisfactory, because of the chlorine in the water, but this trouble is expected to be of only a temporary nature.

A diamond-drill hole near the Errington boundary on the Creighton-Fairbanks property, in Sudbury, cut lead, zinc, and copper at a depth between 1,000 and 1,100 ft. Assay returns have not been received as yet, but the discovery is regarded as a favorable development.

The new orebody discovered a short time ago on the Flin Flon property of Hudson Bay M. & S. in northern Manitoba appears to be very important. This orebody, previously unknown, was located southwest of the main body, and from the work done to date, and additional developments in the main ore zone, it is understood that the gross value of the ore reserves has been increased to a total of approximately $250,000,000.

On the adjoining Mandy property, shaft sinking has almost reached its objective and underground development will soon be started. A geological reconnaissance of the property has shown favorable conditions between the known ore and the Flin Flon boundary line.

Nichols Copper Refinery Site Will Be at El Paso, Tex.

OFFICIALS of Nichols Copper Company, Phelps Dodge Corporation, Calumet & Arizona Mining Company and New Cornelia Copper Company, interests involved in the proposed erection of a new copper refinery in the Southwest, met on June 1 to formulate definite arrangements relating to the site and construction of the new plant. El Paso, Tex., was selected as the location of the new refinery. Option on ground in the eastern part of that city which has been held pending the decision will be exercised at once. El Paso City Council has assured the new combination of interests of its desire to cooperate in every way possible in making the new site satisfactory to all concerned.

Contract for construction will be signed late this summer and ground will be broken early in the fall. The plant is expected to be in operation in the spring of 1930, and will have a capacity of 100,000 tons of copper per year. Present blister copper production of the Southwestern companies involved is approximately 11,000 tons per month, which is now sent to the Perth Amboy refineries. Tentative plans provide for the treatment of 8,000 tons of this production at the new refinery, and the remaining 3,000 tons will be shipped to a refinery on the Atlantic seaboard to supply Connecticut Valley customers of the member companies. Technical details to be embodied in the new plant will be announced in the immediate future. As yet, no decision has been reached concerning even the fundamental type of treatment, whether multiple or series cell system, to be utilized.

Carp Lake Property in Michigan Will Be Explored

Second Smelting Unit Is Being Built at Calumet & Hecla—New Baltic Shaft Now Down to 1,700 Ft.

WORK has been started at the Carp Lake property, in the Porcupine Mountains in Ontonagon County, Mich. A tunnel is being driven to intersect the lodes traversing the north range of the district, the principal vein being the Carp Lake sandstone conglomerate. Great North Mines has taken over the options held by R. T. Looney, of Houghton, Mich., on Carp Lake, and an additional large acreage of mineral lands. At an approximate distance of 800 ft. it is expected that the adit will cut the principal lode. The vein had previously been opened to a depth of 350 ft. in work done during the 'nineties. Some of the rock at this shallow depth is said to run better than 2 per cent.

At Calumet & Hecla Consolidated's smelter, excavating has been started for the erection of a building which will complete the modernization of the plant. Two large refining furnaces and a smelting furnace have been erected, and steel is arriving for the construction of a second smelting unit to supplement the one already in commission. It is expected this furnace will be completed this year. It will be 20 ft. wide and 70 ft. long, with a capacity of 225,000 lb. of mineral per day. It will be so built that the molten metal will flow by gravity to either of the two large refining units.

In the issue of May 26, it was stated that Isle Royale, a Calumet & Hecla subsidiary, will adopt the retreating system of mining. This statement was gratuitous. Isle Royale adopted the retreating system in 1915.

Sinking of the New Baltic shaft of Arcadian Consolidated to the 17 level from the 12 level has been completed and it is now bottomed at 1,700 ft. A crosscut to the New Arcadian vein will be driven and a second crosscut will be pushed to the wide but as yet unidentified lode on the west, which showed promising grades on the 1,250 level.

Dewatering of the Crocker shaft of the Phoenix mine is being speeded. As the openings are extensive and the caved and crushed condition of the shaft necessitates retimbering, however, it is expected it will be at least 90 days before the work is completed. At Cliff, which is the other base of the Calumet & Hecla exploratory project, an underground pipe line is being laid.

No mining is being done in the three bottom levels at Quincy, but mass and rich vein rock is coming out of the drifts. The 86 level is particularly heavy in mass copper. On the 87 level the deposit of copper in epidote continues to the north, where the drift is in 350 ft. This geological condition is entirely new in Quincy and also in the district. To the south of the same level, where normal conditions prevail, the drift is in about 300 ft. The major part of the repair work in the No. 8 shaft, which is to be reopened, has been completed, and skips are now operating to the 60 level. It is expected that the shaft, which is bottomed at the 77 level, will be ready for use in a month's time.

100-Ton Cyanide Mill Being Erected at Siscoe Gold

PRELIMINARY layout plans for the 100-ton cyanide mill and auxiliary units, and mine and surface power plant, being erected for Siscoe Gold Mines at Amos, Quebec, by Southwestern Engineering, have been completed. Construction, it is expected, will be completed in November.

Two 200-hp. Polar Diesel oil-engine units will supply electric power for mine, mill, and surface operations. Two 70,000-gal. fuel oil tanks will be erected, which will provide storage for nine months' requirements. A 624 cu.ft. Ingersoll-Rand air compressor will furnish air for the underground work and the Leyner drill sharpener. The hoist will be of the Lidgerwood electric type, capable of operating to a depth of 1,000 feet.

A separate crushing plant will be erected in connection with a new 60-ft. headframe and ore bin at the C shaft. Crushed ore from a 12 in. by 20 ft. Universal jaw crusher is to be delivered to the mill bins, of 200 tons' capacity, by a belt conveyor approximately 300 ft. long. The mill flow sheet includes grinding in a Marcy ball mill in closed circuit with a Dorr duplex classifier. Overflow from the classifier will go to a Dorr agitator and then to a Dorr tray thickener. Thickener overflow will go to a Butters type clarifying filter, the clear solution to a Crowe-Vacuum-Merrill precipitation press, and the precipitate to a refinery. Thickener underflow discharges to an American filter with pan divided for double washing. The filter cake goes to a repulper and to a Dorr agitator for further cyanide treatment; then to a Dorr thickener prior to a second and final wash on the filter. The power plant will be completed first and the mine changed over to electrical operation as soon as the delivery of power machinery permits.

Judge Bourquin Appoints New North Butte Receiver

JUDGE BOURQUIN of the federal court has appointed former Judge Lindsay, of Silver Bow County, Mont., to take the places of J. W. Neukom and Matt Essig, who had been appointed receivers of North Butte Mining by the Minnesota court. It is believed that within a short time all suits against the company, including that recently started by the bondholders, will be dismissed, giving the management a free hand to not only develop its east side property but to continue development of the "hill" property, which has not been as fully explored, as well. Paul A. Gow will be in charge of operations.

Newmont Mining Options United Verde Ex. Property

Holding Company Has Until July 2 to Decide on Purchase of Arizona Copper Mine

THE BOARD of directors of United Verde Extension has granted to the Newmont Mining Corporation until July 2, 1928, an option on all the physical property of the company in Yavapai County, Ariz., including mine, mill and smelter, for 60,000 shares of the treasury stock of Newmont Mining, retaining in the treasury liquid assets amounting to about $6,000,000. The terms of the option represent the value of the United Verde Ex. property based on ore in sight and probable ore as determined after exhaustive examinations made by reputable geologists and mining engineers and careful consideration by the management and the directors. In making this option it was believed that United Verde Ex. stockholders would prefer taking Newmont stock at $175 per share rather than cash (which was the preference of the Newmont company), because Newmont stock represents property holdings which have future speculative values.

If Newmont exercises its right of option, a plan will be submitted to the stockholders by which Newmont stock so received when the sale is consummated will be distributed to United Verde Extension stockholders proportionately, and the corporate activities of the company continued.

At a meeting of the board of directors of United Verde Extension held on June 5, a resolution was passed granting Newmont Mining the option herein described and another resolution was passed calling a special meeting of the stockholders of the company to be held at the office of the company on July 6, 1928, for the purpose of the action of the directors.

The offer of disposal of the U. V. X. property to Newmont results from the fact that the ore reserves at Jerome are limited to four years' supply without the chances of finding more being very attractive. Current production amounts to about 245,000 tons a year, and the reserves shown in the last annual report were 960,000 tons, of 8 per cent copper or better.

East Butte May Reopen Mines at Silver Plume, Colo.

B. M. GARTNEY has been inspecting the properties of East Butte Copper Mining, near Silver Plume, Clear Creek County, Colo., which that company may reopen. The properties, including the Dives-Pelican and Seven-Thirty mines, carry three parallel veins, containing silver-lead ore, which are developed by six main tunnels. These mines were taken over by East Butte from Silver Plume Mines in 1922 and operated under lease until 1923, when stock control of the Silver Plume company was purchased.

Electrified Open-Cut Haulage Is Adopted By Utah Copper at Bingham

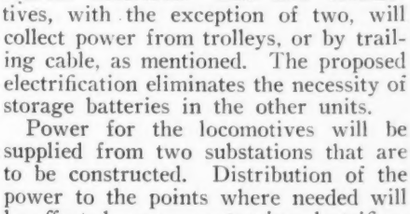
Following a Year's Trial Installation of One Unit, Twenty Electric Locomotives Are Purchased From General Electric to Supplement Shovels Already in Use

WITH the completion of the plans of Utah Copper to electrify the haulage lines on the benches of its Bingham, Utah, mine, as was announced recently in *Engineering and Mining Journal*, the property will be the largest electrified metal mine in the world. A minimum of twenty electric locomotives and a maximum of forty will be used—more than ever before employed in any open-cut mine. Actual mining operations are already electrified, large electric shovels being utilized, but up to the present the haulage system has been of the steam type.

The decision to change over from steam to electric haulage follows a test of about a year with a trial installation of a 75-ton combination storage-battery, trolley, and cable-reel locomotive built by the General Electric Company. This preliminary electrification was so satisfactory that Utah Copper decided to make an initial installation of twenty locomotives of similar type, additional locomotives to be put in service later. Of the first twenty locomotives, only two, however, will be equipped with storage batteries, as was the original unit; the remainder will not have this accessory equipment, and will draw power from overhead and side-arm pantagraph trolleys, or from trailing cable.

The trial locomotive was specially designed for service at the property, the arrangement of the benches making it necessary to operate locomotives by means of each, and all, of the power sources described. The new locomotives, with the exception of two, will collect power from trolleys, or by trailing cable, as mentioned. The proposed electrification eliminates the necessity of storage batteries in the other units.

Power for the locomotives will be supplied from two substations that are to be constructed. Distribution of the power to the points where needed will be effected over an extensive electrification system. The ore cars will be hauled by the electric locomotives up the side of the mountain by means of switchbacks to the benches, where the cars are loaded by the shovels and then hauled back down to the foot of the mountain. At this point the loaded cars are made up into trains and transported over the Bingham & Garfield railroad to the Magna and Arthur mills.



Electric locomotive attached to ore train on one of the benches

The new locomotives are an articulated-truck steeple-cab type with rigid frame made up of heavy steel plate sides that are carried on combination semi-elliptic and helical springs. The main cab of the storage-battery locomotive is more than 10 ft. square; in this cab is the engineer's seat and controls with necessary electric equipment.

Four large totally inclosed electric motors drive each locomotive, the motor armatures running on roller bearings. These motors are controlled by a single-unit three-speed control arranged for series, series parallel, and parallel operation, and equipped with resistors of sufficient capacity for the specified service that are cut in and out by solenoid-operated contactors of proper size to open and close the power circuits. Complete protection and metering equipment is provided by relays and instruments.

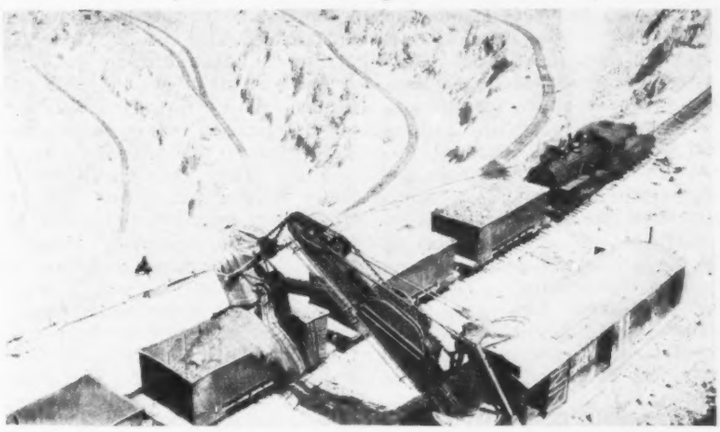
The overhead pantagraph trolley on each locomotive is raised by a spring and lowered by compressed air, both operations being controlled by the engineer in the cab. In addition, there are two side-arm pantagraph trolleys, one mounted on each side of the cab room. These are extended and withdrawn by compressed air controlled by the engineer.

The electric cable reel, mounted under the platform beneath the cab, carries a suitable length of flexible rubber-covered cable, and is of the vertical axis type. It is driven by a motor that automatically winds and unwinds the cable as the locomotive moves toward, or away from, the source of power. The cable is taken from the reel through cable guides to the source of power.

In the storage-battery locomotives, a ball-bearing battery-charging motor-generator set in the locomotive cab is arranged to charge the battery through its control without the use of a charging resistor. It is complete with all necessary control and protection.

A two-stage railway-type air compressor in the locomotive cab also provides the air necessary for operating the double-end locomotive air brake equipment. The locomotives without storage batteries are practically identical with those described except for the battery, charging equipment, and other accessories not needed when the battery is not used. All the locomotives are being built at the General Electric shops at Erie, Pa.

Several of the benches showing electric shovels in place



An electric shovel loading ore cars on one of the benches; the steam locomotives on the benches are to be replaced by electric units

Court of Appeals Upholds Carson Claims in Anaconda Case

Siemens Furnace Adjudged Failure—Originality and Practicability of Carson Ideas Upheld—Another Injunction Awarded

ON THE merits of the case, Carson Investment Company *v.* Anaconda Copper Mining Company, in which infringement of the Carson reverberatory copper-furnace patents was charged against the Anaconda company, the U. S. Court of Appeals at San Francisco decided in favor of the Carson company on May 28, 1928. Justices Hunt and Rudkin concurred and Justice Dietrich dissented. The decree of the Appellate Court reversed the Bourquin decision in the Circuit Court of Butte, Mont., and remanded the case with directions to award injunction and proceed in the usual manner to an accounting.

In their opinion, Justices Hunt and Rudkin held that in the Anaconda experimental furnace there were important differences with Siemens' furnace. The experimental furnace had sides inclined at 60 deg., but the Siemens patent states that the incline must be such as to maintain the ore thereupon by its own gravitation—this is therefore a departure from the Siemens disclosure. The use of a thick magnetite lining on the bottom of the furnace was not described by Siemens. The Carson patent shows vertical walls or walls substantially vertical. Thus the court held that the Anaconda furnace was not the same as Siemens and that the Siemens furnace was a failure and never went into use. Copper-smelting furnaces of 1866 disclosed nothing essential to the case. Other Siemens patents have no bearing. The contention that Carson had made false representations as a result of his West Berkeley, Calif., experiments with pyrrhotite was dismissed and declared irrelevant.

In considering the Dollar Bay furnace of the Lake Superior Smelting Company the court acknowledged a conflict of evidence and stated that there was no proof that any person other than Carson ever conceived the idea of dispensing with fettling by banking the ore against the furnace sides; and, furthermore, that even if other furnaces were, in fact, operated in the manner asserted by American Smelting & Refining, it must have been done "without any conception of the inventive idea" that underlies the Carson patent.

The defendant denied infringement, but the court upheld the Carson ideas. By using the Carson invention to its full extent in protecting the side walls from heat, yet using it to a substantial extent, defendant cannot avoid infringement. The court held that the change in the form of construction so that the bath is transferred from one end to the other does not avoid infringement.

Respecting lack of title in Carson, the court held that Carson had a sufficient interest and subsequent trustee arrangements were held proper.

The Court states: "After careful consideration of all the points urged, our conclusion is that the new evidence calls for no change in the decision reached in our former opinion, and that the District Court was in error in rendering a decree holding the patents invalid, and in finding no infringement and dismissing the complaint."

Justice Dietrich, in his dissenting opinion, contended that the Anaconda test furnace is practicable and that the evidence established beyond a reasonable doubt that both the Siemens and Carson patents are embodied in it. He states: "But grant for the sake of argument that Siemens' walls are too flat to accomplish what he so fully describes in his patents—none the less they serve for anticipation.

"Moreover, as I understand the operation, the course of the smelting ore in its descent into the bath and to the floor is substantially the same whether the furnace walls be perpendicular or inclined, such course approximating the plane of the angle of repose. In the case of a perpendicular wall the ore in the heap back of the plane of repose remains in repose, so that the real wall down to the surface of which the smelting ore reaches the floor approximates the angle of repose. That this is true would seem to be manifest, and its concession is necessarily implied in Carson's contention that his patent covers an inclined, as well as a perpendicular wall. If the maintenance of a triangular section of the heap, bounded by a perpendicular side wall, the floor, and the plane of the angle of repose, is essential to his conception, he could not claim infringement by a furnace of the Anaconda structure, having walls inclined 60 deg."

Jack and Jill Mill Not to Be Reconstructed at Present

RECONSTRUCTION of the Jack and Jill mill of the Domada Mining Company, situated west of Cardin, Okla., in the Tri-State district, which was destroyed by fire on May 18, will not be attempted at present, according to Charles Neal, manager. The loss is placed at about $50,000. Ore from the Jack and Jill lease has been milled at the Kitty mill since the Domada acquired the latter property. The company had expected to convert the Jack and Jill mill into a tailing mill to handle material from both the Jack and Jill and the Kitty mines. A complete tailing mill will probably be built on the Jack and Jill site some time this fall, Mr. Neal said.

Operations have started at the Mary M flotation plant, recently completed west of the Kitty mill. The plant is equipped with four Butchart flotation machines, a filter, and a 5-ft. Hardinge ball mill. Sand and slime are being treated at present.

A newly organized company, Western Lead & Zinc, has taken over the old Commonwealth No. 2 mine, south of Baxter Springs, Kan. According to Jesse Richards, superintendent, some good ore is being developed.

Gus Bramer and associates have taken an option on the Vantage No. 5 mine, northwest of Baxter Springs. The property adjoins the Brugger lease of the Century Zinc Company, which was recently purchased from Vantage Mining.

American Murdered on May 30 at Santa Gertrudis

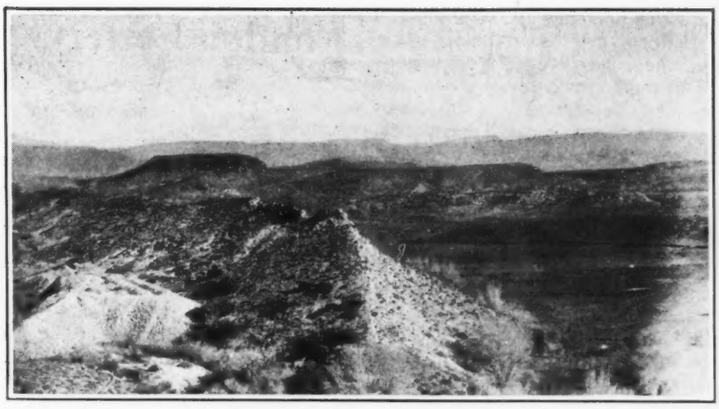
HOWARD C. SMITH, mining engineer at the Don Carlos mine, in the Pachuca district, State of Hidalgo, Mexico, was assassinated on May 30. Officials at the mine attribute the murder to a "piece of bitter revenge." His assassin has not yet been caught. H. F. A. Schoenfeld, the American chargé d'affaires at Mexico City, has made appropriate representations to the Mexican government with a view to the apprehension and punishment of Smith's assailant.

Mr. Smith was born in New York State. He studied at the Colorado School of Mines at Golden, Colo. Since 1917 he had been connected with the Santa Gertrudis company. He was put in charge of the Don Carlos silver mine, which is the property of the Compañia Beneficiadora de Pachuca, a Santa Gertrudis subsidiary. His body was sent to Denver for burial. Mr. Smith is survived by his widow and a son.

First Dredge at Fairbanks Is Ready for Operations

AS SOON as the electrical installation is completed, the Fairbanks Exploration Company's dredge at Goldstream will start operations, and what has been described as the greatest alluvial gold mining enterprise in the history of Alaska will be under way. Good progress has been made on the assembling of the second dredge, which is being set up at Chatanika, so that these dredges will be operating according to schedule, which was given as the beginning of August.

It is estimated that the expenditures of the Fairbanks company, which is a subsidiary of U. S. Smelting, Refining & Mining, for tunnels, siphons, power house, construction of ditches, hydraulic and dredging plants have amounted to $10,000,000. The enterprise has an estimated life of 25 years. By next spring the company expects to have a fleet of four dredges in operation, with two others to follow. The contracts for these dredges were placed with the Bethlehem Steel Works, at San Francisco.



Outcrop of ore-bearing sandstone on the Silver Reef property

A. S. & R. Begins Operations at Silver Reef in Utah

AN EXTENSIVE development and exploration program was started last week at the Silver Reef property, 20 miles from St. George, in Washington County, Utah, by American Smelting & Refining, which recently acquired a controlling interest in the property from the Consolidated Gold Corporation.

Ground is being cleared for the sinking of a vertical three-compartment shaft, which is expected to encounter the orebody at a point 500 to 550 ft. below the surface. As soon as actual sinking begins, a crew of 20 to 30 men will be employed, operations being in charge of C. C. Cushwa, superintendent, and J. S. Hyde, master mechanic. A. Colbath, organizer of the Silver Reef enterprise, is being retained in a consulting capacity by the smelting company.

Low-grade silver ore, containing some copper, is found in two sandstone beds, known as the Buckeye and White reefs, the outcrops of which may be traced in the general shape of two horseshoes. These reefs, dipping from 20 to 30 deg., were worked in the 'eighties through several inclined shafts, extending a maximum distance of 800 ft. along the dip, or approximately 400 ft. vertically below the surface. The beds appear to have a uniform thickness, and, although the metal content is low, there is evidence that sufficient tonnage may be developed to warrant extraction operations. The object of the present development is to prospect the continuation of the Buckeye reef at depth and to open up the old workings in this reef, which are now inaccessible.

Erection of surface buildings is under way, and the transformer capacity is being increased to handle the electrical power requirements of the equipment being installed, which includes a large double-drum Ottumwa electric hoist and a 985-cu.ft. Chicago Pneumatic compressor.

Shipping Ore Found on 400 Level of the Joe Dandy

ON THE bottom, or 400, level of the vertical shaft, Butte Copper Consolidated has encountered the quartzite hanging wall of the main orebody at its Joe Dandy mine, at Radersburg, Broadwater County, Mont. The quartzite has been penetrated for 10 ft. and shows silver-lead ore of shipping grade. It was encountered at a point about 50 ft. from the lime-quartzite contact bedding plane, which carried silver-lead ore on the 300 level. A station and sump are being cut, after which crosscuts will be run to determine the extent of the main orebody as well as the four other orebodies encountered on upper levels.

At a point 120 ft. west from that where the No. 2 vein was first encountered, Ardsley Butte has opened 5 ft. of high-grade silver ore on its Highland property in the Butte district. Ore encountered in a winze below the 350 level has been drifted on to the east for a distance of 15 ft., the orebody showing a width of about 8 ft., with 2 ft. of high-grade ore.

At the East Pacific property of Montana-Idaho Mines near Winston, Broadwater County, the shaft is now 80 ft. below the No. 7 level. The Kleinschmidt mine and mill of the company in the same district are operating steadily. The ore carries silver, lead and gold.

Potash Found in New Brunswick, Canada

ACCORDING to a Department of Mines bulletin, a well, in search of oil and gas, was sunk to a depth of 1,878 ft. and penetrated a bed of rock salt 485 ft. thick recently at Gautreau, New Brunswick, Canada, about 8 miles southeast of Monctom. Chip samples, taken for every five feet, were found to contain potash.

It was impossible to determine the exact form in which the potash occurs, but polyhalite, kainite, and carnallite are the most probable minerals present. H. C. Cole, of the Mines Branch, states that the locality would appear to be well worthy of further examination by methods especially designed to recover, in the form of drill cores, a complete section of the potash-bearing beds.

Four Government Tests Strike Potash in Texas

ANOTHER substantial find of potash discovered through governmental agencies was made public by the Interior Department at Washington, D. C., recently. The U. S. Geological Survey has recently completed its analyses of cores received from four test wells drilled by the U. S. Bureau of Mines. In the interval between the depths of 1,935 ft. 7 in. and 1,945 ft. in well No. 4, drilled in southeastern Ector County, Tex., are two potash beds that have a combined thickness of 6 ft. 7 in. and together contain 12.86 per cent of potash in the sample as received, equivalent to 18.98 per cent in the soluble salts. These beds are separated by a third bed of common salt, 2 ft. 10 in. thick. Other potash beds of commercial interest were encountered in the same well and in test well No. 7, drilled in Upton County, Tex. The only potash mineral recognized in these was polyhalite.

Nelson Mining Will Develop Iron Mine Near Coleraine

A NEW iron mine will be developed in the near future by Nelson Mining in sections 3, 4, and 10, in Grand Rapids Township, between Coleraine and Grand Rapids, Minn. It is named after the late Colonel J. C. Greenway, who was in charge of operations for Oliver Iron Mining when Coleraine was built. The fee owners are all Minneapolis interests, and the mine will be developed as an independent property, with P. H. Nelson, of Duluth who developed the property, as president.

The new corporation is capitalized at $1,050,000. Work will start this summer with the stripping off of the overburden, which varies from 10 to 50 ft. in depth. No ore will be mined until next year, when a washing plant of 400,000 tons' season capacity will be constructed.

Work on Verde Central Mill Is Started at Jerome

GROUND has been broken for Verde Central's new mill at Jerome, Ariz. The building will be 160 ft. long and 70 ft. wide, and will be built on a site 600 ft. from the shaft collar. Ore will be transferred from the shaft to the mill over a narrow-gage railroad. The new concentrator will have a capacity of 300 tons. The thickener and filter plant will be housed in a separate building. Concentrates will be sent to the United Verde Extension smelter at Clemenceau.

Stopes will be started on the 1,000, 1,100, 1,400, and 1,900 levels in the Verde Central mine. Ore will be mined by the shrinkage and the cut-and-fill methods. R. H. Dickson is manager of the property. He came to Jerome from the Eighty-Five mine, in New Mexico, a property of Calumet & Arizona Mining, which owns the controlling interest in Verde Central.

Mexico City Letter

By W. L. Vail
Special Correspondent

Mexican Congress Fails to Take Any Action on Labor Legislation

Mexico City, May 26, 1928.—Failure of the special session of the Mexican Congress, which has just adjourned, to take action on the proposed labor law comes as a relief to the mining industry. The question will undoubtedly be considered by the incoming administration, which at present points to the ascendancy of General Obregon, whose ideas on labor legislation are well known. The business interests are not opposed to the adoption of labor legislation, but desire that it may be fashioned after similar legislation which has been successfully employed in other countries. Mining and industrial chambers throughout Mexico have been working to that end with committees from both houses of Congress.

It is reported that working options have been extended to one of the largest mine groups now operating in Mexico for properties covering the faulted portion of the Mother Lode in Guanajuato and that diamond drilling will start soon for the purpose of ascertaining conditions. As previously announced, the lode was discovered some months ago by the Peñoles company at a depth of 1,070 ft. Old-time operators in the camp are quite confident that ore will be encountered.

An addition of 30 stamps is soon to be made to the mill of the Pacific Mining Company at Los Lugos, Zacatecas. The enlarged plant will handle 200 tons of ore daily. W. H. Mitchell is manager of the company. Reports from western Zacatecas state that very little work is being done, because of the unsettled political situation.

The La Trinidad mine, in Sonora, which has been idle since the revolution of 1910, is to be reopened soon, and the old mill and smelter will be repaired and put into operation. Development work on the lower level is reported to have opened up a vein of high-grade silver ore, averaging 2½ ft. in width. The property is owned by Los Angeles interests.

On July 1 work will begin on a new automobile road from Nogales, Ariz., to Guaymas, Sonora, which should provide an outlet for properties not worked hitherto, because of transportation difficulties. A part of this project is to establish water connection with La Paz, Lower California. Some ores from the southern part of Lower California will go by water to Guaymas.

The Cabrita mine, in Chihuahua, is being reopened by Southwestern Exploration, and plans have been perfected to push development of the property. A Radiore survey is now being made to determine the presence of sulphide deposits. Efforts are again being made to revive the road project from Guanacevi, Durango, to connect with the railway at Tepehuanes. The San Andreas de la Sierra, near Tepehuanes, is employing several hundred men and doing considerable development work in addition to the regular extraction of silver-lead-zinc ores from the Bertha, El Naranjo, and Nelfa mines.

A number of new denouncements were made during May for exploration in zones bordering on the states of Durango and Sinaloa. Heavy shipments of bullion continue via Mazatlan to San Francisco, and that section appears to be practically free from bandit activities. The North American Lead Company, which recently acquired properties at Vincente Guerrero, is preparing to resume operations, which were stopped for a short time by trouble with water.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Mount Morgan Interests Sold to Broken Hill Smelters for £600,000

Melbourne, May 2, 1928.—An important transaction arising out of the liquidation of Mount Morgan Gold Mining has just been completed. The liquidators have disposed of the company's interests in Electrolytic Refining & Smelting and Metal Manufactures, both situated at Port Kembla, New South Wales, to Broken Hill Associated Smelters for a price exceeding £600,000. As the total cost of the shares to the Mount Morgan company was £317,500, the transaction appears to be a satisfactory one. It also explains why the value of Mount Morgan shares on the stock exchange has appreciably increased during the last month. The purchasing company is not a public company, all its shares being held by the Broken Hill mining companies.

W. A. Freeman, mining engineer, of Sydney, has concluded an agreement on behalf of Placer Development, Ltd., of Vancouver, Canada, with Guinea Gold, Ltd., for an option over the company's leases on the Lower Bulolo River, comprising the dredging area, with water rights for electrical power held by Guinea Gold South, Guinea Gold Central, and Guinea Gold North. The option has been secured on consideration of £50,000 cash, together with 10 per cent of the issued capital of any company or companies which may be formed to work the areas. The completion of the purchase is to be deferred until the government road to the field, which is now being started, is completed. Intensive testing work is to be undertaken forthwith.

London Letter

By W. A. Doman
Special Correspondent

Spanish Government Claims Rio Tinto Understated Copper Content

London, May 22, 1928.—A sensation was caused in mining circles last week by a notice issued by the directors of Rio Tinto. It appears that the Spanish government has denounced the company for understating the copper content of its export ore, with a view of evading the payment of the export tax. This is naturally a serious allegation, and the board took the matter up at once. Although a long circular has been sent out, the whole position is not clear. There is a reference to the reorganization of the staff and management, and "as an inevitable result certain ex-members of the staff have vindictive feelings toward the present board and are apt to make charges against the company which cannot be fully substantiated on investigation." Sir Auckland Geddes has signed a letter, which was sent by special courier to the Prime Minister of Spain, and it requests the Spanish government to make the fullest investigation for the years 1926, 1927, and 1928, for which years alone all relative documents are available. For the years before 1926 the board will assist the government to make any investigation it may desire, but the present board has no direct knowledge of the conduct of the company's affairs in those earlier years.

Such charges, brought against one of the most substantial mining companies and under such an unquestionably honorable board, have aroused the keenest interest. Sir Auckland Geddes seems in his letter to have a complete answer to the Spanish authorities. He writes, "It is well known that the Marques de Estella, according to his own statements, formed his government in 1923 with the view, among others, of getting rid of corruption in Spain. That payments were being made by the company to officials of the Spanish customs is not denied. These were apparently universal. They were investigated by the government of the Marques de Estella in 1923, and because it was found impossible for the Spanish customs officials to live without these additions to their salaries, the government of the Marques de Estella, by royal decree issued on Nov. 20, 1923, made such payment legal and binding on the company as on all others."

Another cable message has been received by Shamva Mines (Rhodesia) stating that a new orebody has been cut on the No. 6 level and assays 6¾ dwt. over a width of 20 ft. A drive, extended 20 ft., averages 6½ dwt. The average value of the reserves is only 3.2 dwt. and over 2s. per ton profit is earned.

Danger at Hollinger Not Realized, Justice Godson Reports

Conditions at the Mine Led to Belief in Physical Security by Management and Miners, Despite Practice of Dumping Inflammable Refuse Underground

THE REPORT of the Royal Commission appointed to inquire into the Hollinger mine disaster of Feb. 10, in which 39 lives were lost, has been presented by Justice T. E. Godson, the commissioner. He reports that lack of co-ordination in the organization of the Hollinger company resulted in a disjointed system of control, thereby permitting the improper dumping of thaw-house refuse in empty stopes where there was no concurrent act of back filling or covering. The danger of such a practice was not realized by those who ordered or permitted it, or by those who actually disposed of the refuse. There was an omission on the part of the general manager in not inquiring or knowing how and where such inflammable thaw-house refuse was being placed. The assistant manager was remiss in not personally satisfying himself that the refuse was being properly disposed of. The general superintendent, mine superintendent, and other officials knew or ought to have known that thaw-house refuse was not being thoroughly mixed with or fully covered by waste rock, sand or gravel, and therefore in this condition constituted a menace.

As to the duty of the government mine inspector to examine into and make inquiry respecting the state and condition of any mine, the commissioner reports that the inspector at Porcupine did make inquiry as to how thaw-house refuse was being disposed of, but, upon being assured by the Hollinger safety inspector that the refuse was being sent through the central waste pass, his mind was satisfied and the inquiry ended. An examination would have shown that the safety inspector's statement was partially but not wholly true, as thaw-house refuse was being sent only at times through the central waste pass and more frequently to stopes where back filling was in process or had been definitely suspended. The statutory duty of the inspector and the responsibility of the officers and management are a separate and distinct application, the report states. Each has a stern duty imposed by law. Neglect of one does not relieve the responsibility of the other. The duties of the government mine inspector are circumscribed, those of an operator or management unconfined in connection with or relating to the safety of the persons employed in a mine. The report states that it was not forgetfulness on the part of the mine inspector, but passivity. An assurance had been given and accepted; it ended there. Nor was it willful misstatement of a fact on the part of the Hollinger safety inspector, but a reply given in ignorance of a fact that it was his—the safety inspector's—duty to know.

The commissioner states that the dry thaw-house refuse was of an inflammable nature and, as such, an apparent fire hazard. Its proper disposal therefore was of the utmost importance as a measure of protection against the occurrence of fire. By a decision of the general superintendent and the mine superintendent made about 1923, two options were given for disposal. One was through the current waste pass where it would be intermingled with the waste flow to be drawn off the lowest level, used as a back fill, or be taken to the surface, redumped and again sent down the mine to be used where needed. This process was a reasonably safe method of disposal. Second, by dumping direct to stopes which were being back filled. This method without complete dilution or mixing of the refuse with waste imparted a danger. A duty was therefore imposed upon the general superintendent and the mine superintendent to see that this prescribed manner of disposal was being properly and safely carried out. In this duty they failed.

The practice of dumping thaw-house refuse in empty stopes where back filling was not being done was a dangerous and hazardous plan, which seems to have been adopted without orders from the general superintendent or the mine superintendent. From a system of permissible dilution the practice become one of complete segregation of inflammable rubbish. The failure to issue written orders respecting the method of disposal of refuse and the absence of any complete record prior to April, 1927, of stopes in process of being back filled were contributing causes to the fire. The general manager and the assistant general manager cannot disassociate themselves from responsibility for their organization and, in the opinion of the commissioner, the responsibility of the general manager and the assistant general manager is not limited in extent or time when it concerns the safety or protection of the workmen or others under them.

It is a fact that thaw-house refuse was being placed in stope 55A for two or two and one-half years prior to the fire, and it is an additional fact that stope 55A had not been back filled since April, 1927. It is further in evidence, and the commissioner finds as a fact, that this condition prevailed during 1926 or earlier. The workmen who disposed of the refuse and those who saw or knew of it being so placed were intelligent, practical miners, capable of appreciating the danger of the act, and owed a duty to their fellow workmen to report the fact to the safety inspector or superior officer, or the government mine inspector. The danger was not recognized by those who ordered or permitted it or by those who actually disposed of such refuse. From the general manager down the scale of the organization to the muckers no one thought of a fire occurring underground. All minds were oblivious to the fact that thaw-house refuse, being highly inflammable, was a dangerous substance when so left underground. This security of mind is mainly accounted for by a number of accumulated circumstances. On the part of the management and organization, because of concentration on production, immunity from metal-mine fires in Ontario, a wet quartz mine, absence of timbering in quantity, and the amount of refuse being insignificant in comparison with other major operations of the mine, the danger became obscured. To the men who dumped the waste or saw it being placed without complaint, the habitual use of oilskins as a protection against wet induced a placid state of mind, the reliance upon the judgment of experienced officials, and the stope itself, with its dripping walls, gave a sense of security. Those who guided the activities of the mine and those who gave their services one and all testified to a belief in a state of physical security. This outstanding fact must be based upon some outstanding reason and cannot be dismissed lightly in measuring the degree of neglect or responsibility for what occurred. The commissioner states that he has given reasons why this state of mind prevailed, and if the suppositions that he advanced are tenable, the fault can be laid to neglect of a condition that became obscured—lost track of in the concentrated effort for increased production—which the directors as a body of business men properly concentrated on and which the shareholders had a right to expect. There was a dependence by the management upon officials and by those officials upon the workmen, but no one saw to it that the chain of continuity of action was complete.

Judge Godson's report is in two parts, the second of which has yet to be completed. Part one, which has just been made public, deals with the cause and the responsibility of the fire; part two will contain suggestions and recommendations looking toward the greater security and safety to mining operations.

M. I. T. Announces Summer Camp at Dover, N. J.

FORTY miles northwest of New York City, the summer mining camp of the Massachusetts Institute of Technology will again offer students of mining engineering an opportunity to engage in active field work during the coming summer. The ten-acre site of the camp is leased from the Warren Pipe & Foundry Corporation, which owns several thousand acres of mineral lands in the vicinity, from which 600,000 tons of iron ore are produced yearly. Camp session extends from July 23 to Sept. 18.

Personal Notes

GEOFFREY D'EGVILLE, mining editor of *Canada*, a London publication, is making a tour of the Canadian mining districts.

DOUGLAS F. HAMELIN, mining engineer, has been engaged as resident engineer of Flintoba Mines, Ltd., in northern Manitoba.

M. B. GLAZIER, engineer of Ribago Copper, is making an examination of properties in the Sudbury district of northern Ontario.

A. J. ORENSTEIN, of the Corner House staff, sailed from Johannesburg recently to attend the International Labor Conference at Geneva, Switzerland.

W. I. HEDDENS has been elected to the board of Lucky Tiger Mining, which owns properties in Sonora, Mexico, to succeed CHARLES M. BUSH, resigned.

STEPHEN S. TUTHILL, the secretary of the American Zinc Institute, Inc., has been elected president of the Trade Association Executives of New York City.

A. H. HUBBELL, associate editor of *Engineering and Mining Journal*, left New York on June 4 on a trip through the mining districts of Ontario and Quebec.

J. G. SHEPARD has accepted a position with Anaconda Copper at Butte, Mont. Mr. Shepard was Metal Mine Inspector for Alaska of the U. S. Geological Survey.

D. D. MUIR, Jr., manager of U. S. Smelting, Refining & Mining, returned by airplane to his Salt Lake City headquarters on May 31 from a business trip to San Francisco.

C. P. WHITE, of the Economics Branch of the U. S. Bureau of Mines, was recently in San Francisco and left to visit the Northwest states en route to Washington, D. C.

S. M. SOUPCOFF, mining engineer of American Smelting & Refining, left Salt Lake City May 29 on an inspection trip to mining properties in Nevada, California, and the Northwest.

J. W. HENDERSON, formerly of Ouray, Colo., and later of Oatman, Ariz., is now in charge of exploration work for United Eastern Mining at that company's South Fork property, Forest, Calif.

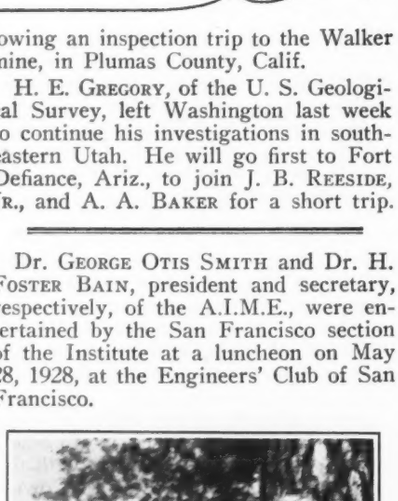
R. T. WALKER, geologist of U. S. Smelting, Refining & Mining, returned recently to the Salt Lake City offices of the company, after making an examination of the Cerro Gordo Estelle properties, near Keeler, Calif.

J. F. WRIGHT, of the Canadian Geological Survey, will make an examination of the Sherritt-Gordon mine and other properties in the Cold Lake district of Manitoba, and map an area of several hundred square miles.

J. O. ELTON, manager of the International Smelting Company, and TOM LYON, head geologist of the company, returned to Salt Lake City June 1, following an inspection trip to the Walker mine, in Plumas County, Calif.

H. E. GREGORY, of the U. S. Geological Survey, left Washington last week to continue his investigations in southeastern Utah. He will go first to Fort Defiance, Ariz., to join J. B. REESIDE, JR., and A. A. BAKER for a short trip.

Dr. GEORGE OTIS SMITH and Dr. H. FOSTER BAIN, president and secretary, respectively, of the A.I.M.E., were entertained by the San Francisco section of the Institute at a luncheon on May 28, 1928, at the Engineers' Club of San Francisco.



DR. BAIN and DR. SMITH say "Here's how" (but not what) in the Yosemite Valley, California, on their recent trip through the West

E. J. BUMSTED has been appointed general manager of Alvarez Mining, which is operating the Humbolt mine, at Ixtlan, Nayarit, Mexico. Southwestern Engineering is installing a modern flotation mill for the company.

G. TOWNSEND HARLEY has severed his connection with the operating staff of the Memphis Corporation, and for the next three or four months will be engaged in mining and geological work with headquarters at Las Cruces, N. M.

ALFRED TELLAM, of General Engineering, sailed from New York on May 24 for Jumasha, Peru, where he will supervise the construction and operation of a flotation plant that the company will erect there for the Vanadium Corporation of America.

R. C. BAUERMEISTER, consulting engineer of Salt Lake City, has returned to his headquarters there, following a recent visit to the St. Lawrence property situated near Ely, Nev. Development operations at the St. Lawrence are under the direction of Mr. Bauermeister.

S. MIYOSHI, mining engineer in charge of all tunnel work for the Imperial Japanese Railways, has been visiting Arizona mining districts. Mr. Miyoshi says that Japan plans to build 22,000 miles of new railroad during the next twenty years. The work will include about 600 miles of tunnels.

HARLEY A. SILL has been made consulting engineer and general manager for the San Nicolas Mining Company at Vincente Guerrero, Durango, Mexico. The company is preparing to reopen its 300-ton mill and treat 250,000 tons of old tailings on the dumps. It will also reopen its three mines, the Vacas, San Marcos, and Quebradilla.

G. L. OLDRIGHT, supervising metallurgist of the non-ferrous metallurgical branch of the U. S. Bureau of Mines, returned recently to his Salt Lake City headquarters at the Intermountain Station. Mr. Oldright left Salt Lake last February, and has spent the intervening period in Washington, D. C., and at the Southwest Experiment Station at Tucson, Ariz.

JAMES L. BRUCE, resident director of the Cyprus Mines Corporation, is returning to the United States with his family for a vacation of several months. Mr. Bruce expects to reach New York about July 10, and from there he will proceed to Denver. His address there will be care of V. G. Hills, 2678 Hudson St., Denver, Colo. Mr. Bruce will return to Cyprus in October or November.

OBITUARY

DR. JOHN HORNE, well-known geologist, died at Edinburgh, Scotland, on May 30. Dr. Horne entered the Geological Survey of Scotland in 1867, and in 1911 was made its assistant director. He was 80 years old.

FRED S. HILL, a brother of the late John A. Hill, head of the publishing company that bore his name, died on May 30 in Denver. For a number of years Mr. Hill had been representing the McGraw-Hill Publishing Company interests in the Denver territory, following an extended period as Western Manager of *Engineering and Mining Journal*. He was born on Aug. 4, 1864.

WILLARD F. SNYDER, who had been active in Utah mining since 1889, died at Salt Lake City on May 29. Mr. Snyder had been in poor health for several months. He was responsible for the organization of Western Exploration, which owns properties in Shasta County, Calif.; Combined Metals, a Nevada company which joined with St. Louis Smelting & Refining in organizing Combined Metals Reduction; Bristol Silver, a silver-lead property near Pioche, Nev.; and Raymond Ely Extension, another Pioche mine. Mr. Snyder was also the president of Eureka Lily, one of the Tintic district subsidiaries of Chief Consolidated; Silver Reef Consolidated, a Washington County, Utah, property; National Development; and Park Premier.

Book Reviews

THE BEHAVIOR OF PRICES.—By Frederick C. Mills, staff of the National Bureau of Economic Research, Inc., New York. Cloth, 6x9 in., pp. 598. Price $7.

PRICES and price relations play a fundamental part in the production, distribution, and consumption of goods. Changes in prices of commodities stimulate or retard production and consumption. But in addition there are numerous relations which tie all prices into a highly complex system, "a system like a living organism in its ability to recover from the serious disorders into which it periodically falls." "The Behavior of Prices" has as its objective, first, to secure a fuller understanding of individual commodity prices and, second, to increase our knowledge of the price system and of the inter-relationships between its component elements.

Two significant facts are brought out by the study: first, the existence of wide diversities in the behavior of prices of individual commodities, and, second, the existence among the diversity of price movements of just those uniformities for which the scientist searches in attempting to reduce masses of facts to understandable terms. The present study and the research which has preceded it in this field have gone only a little way in the search of principles of order among the variations in the price system, but numerous inter-relations and uniformities have been revealed, and many clews to other regularities have been found. It is in the existence of these regularities that lies the hope of a fuller understanding of the working of the system of prices.

CEMENTS, LIMES AND PLASTERS, Third Edition. By E. C. Eckel. John Wiley & Sons, New York, 1928. Price $7.

IN THIS AGE of rapidly changing technique, new editions are always welcome. The first 632 pages of this book are almost identical with the second edition, with the addition of later figures in statistical tables, and some additional later references. Although the cost figures given in many places are long out of date, the commodity-price index given on page 7 permits one to deduce figures that apply approximately to present-day conditions. Most of the information is fundamental and therefore demands little modification, but many changes in technique, and some changes in basic principles, unfortunately have not been covered in this revision.

Since the second edition was published in 1922 rapid progress has been made in the development of alumina cements and high-strength portland cements. These outstanding accomplishments are covered in detail in Part VIII, comprising the last 44 pages of the book, and consisting entirely of new material. As the author has been intimately connected with the growth and development of these newer types of cement, the subject matter may be regarded as exact and authoritative. The section begins with a discussion of the raw materials required for alumina cements, the most important being bauxite. Fusion of the raw materials can best be accomplished in vertical shaft furnaces. The range in composition is shown in comparison with portland and slag cements, and the resistance of alumina cement concrete to acid waters is emphasized. It exhibits normal set and very high early strength, the 24-hour strength equaling that of 28-day portland cement. This quality, together with its superior strength in mortars and concretes, gives it high engineering value. In discussing the accelerated portland cements, which attain normal strength in two or three days, it is pointed out that their manufacture demands careful selection of raw materials with a tendency toward a high lime content, or, more properly, toward a higher content of tricalcium silicate. Careful clinkering and very fine grinding of the clinker are essential. The field of utilization of these new types of cement is discussed. The author foresees a broader application of the special types of cement, and, for their most efficient manufacture, decided changes in plant design may become necessary. OLIVER BOWLES.

UTAH MINING — "Utah, America's Great Mining and Smelting Center," the 1928 annual booklet on mining issued by the Salt Lake City Chamber of Commerce, is ready for distribution. The booklet, which contains 32 pages and is well illustrated with numerous photographs and maps, was prepared under the supervision of Gail Martin, mining editor of the Salt Lake *Tribune*. Copies may be had free on application to the Salt Lake City Chamber of Commerce.

GEOLOGY, PERU—Vol. 2 of the *Bulletin* of the Geological Society of Peru has been received. Its content includes the following papers: "Physiography and Geology of the Province of Pasco," by Manuel B. Llosa; "Some Data on the Geology of Ancachs," by Bernardo Boit; and "The Asphalt Region of Santo Domingo," by Jorge A. Broggi.

ZINC METALLURGY—T. P. Campbell, associate professor of metallurgy, Colorado School of Mines, writes on "The Electro-deposition of Zinc from Ammoniacal Carbonate Solutions" in the Colorado School of Mines *Quarterly*, dated January, 1928, which has just come to hand. The article contains 38 pages.

ALLOYS—The Niagara Falls Smelting & Refining Corporation, 2204 Elmwood Ave., Buffalo, has issued a 64-page book of convenient size entiled "1001 Alloy Formulas." This has been prepared by Ernest G. Jarvis. The company will send it free upon request.

MANGANESE—Harold P. Banks, manager of the ore and metals department, W. R. Grace & Company, is the author of a two-page article entitled "Mining Manganese in Chile," which appears in the March-April issue of *The Grace Log*. Mr. Banks states that manganese ore is again being actively mined in the Las Canas district of Coquimbo Province.

MOLDING SANDS—Another bulletin of the Pennsylvania Survey is No. M 11, entitled "Molding Sands of Pennsylvania." It has been prepared by R. W. Stone, and includes a description of tests of the Pennsylvania molding sands made by the American Foundrymen's Association. The bulletin contains 94 pages.

COLORADO GEOLOGY — The Colorado School of Mines *Quarterly*, Vol. 21, No. 3, is devoted to a bibliography of the geology and related subjects of northwestern Colorado. The author is J. Harlan Johnson. No. 4 of Vol. 21 contains a bibliography of the geology of the north central part of the state by the same author.

TOPOGRAPHY.—Bulletin 788-E of the U. S. Geological Survey is entitled "Topographic Instructions of the United States Geological Survey." It is devoted to the subject of topographic mapping. W. M. Beaman is the author. The work comprises 378 pages.

HYDRAULIC CLASSIFICATION — The April *Bulletin* of the Institution of Mining and Metallurgy, London, contains a 20-page article entitled "High Velocity Hydraulic Classification," by Leonard Andrews.

MINING ACCIDENTS, ONTARIO—The Ontario Department of Mines has issued Bulletin No. 63, which is a report on mining accidents in the province during 1927.

DIAMONDS—The issue of *The Mining Magazine* of London for May contains a contribution from Smith Bracewell, assistant government geologist of British Guiana, in which he describes the Potaro diamond district of that country.

Government Publications

METAL MINE GASES—U. S. Bureau of Mines Reports of Investigations, Serial No. 2865, is entitled "Rock-Strata Gases in the Cripple Creek District and Their Effect on Mining." The authors are E. H. Denny, K. L. Marshall and A. C. Fieldner.

RARE METALS—U. S. Bureau of Mines Reports of Investigations, Serial No. 2873, is entitled "Notes on Extraction and Recovery of Radium, Vanadium, and Uranium from Carnotite." The author is H. A. Doerner, associate chemist at the Rare and Precious Metals Station at Reno.

BABOQUIVARI ORES—U. S. Bureau of Mines Reports of Investigations, Serial No. 2874, comprises a one and a half page article entitled "Milling Baboquivari Ores." The authors are Edmund S. Leaver and Jesse A. Woolf, both of the Bureau station at Reno, Nev.

Market and Financial News

British Columbia 1927 Mineral Production Figures Show Decrease in Value

OFFICIAL figures for the mineral and metal production of British Columbia in 1927 have just been released by John D. Galloway, provincial mineralogist. The 1927 production is compared with that of 1926 in the accompanying tabulation.

Values given for copper and silver are based on the New York prices for the year; the values of lead and zinc on London prices. A feature of the metal production, which came from 132 mines, is the proportion derived from half a dozen big mines. Thus, in round figures, the Sullivan mine, at Kimberley, produced 5,000,000 oz. of silver, 270,500,000 lb. of lead and 132,250,000 lb. of zinc; the Hidden Creek mine, at Anyox, 4,500 oz. gold, 300,000 oz. silver, and 37,000,000 lb. copper; the Britannia mine, at Britannia Beach, 10,000 oz. gold, 160,000 oz. silver, and 34,500,000 lb. copper; the Copper Mountain mine, near Princeton, 4,000 oz. gold, 140,000 oz. silver, and 17,725,000 lb. copper; the Premier mine, near Stewart, 117,000 oz. gold and 3,000,000 oz. silver; and the Nickel Plate mine, at Hedley, 12,750 oz. gold. Total production was derived from 5,416,021 tons of ore. The lode mining industry gave employment to 2,670 men underground and 1,916 above, besides 854 employed in concentrators and 2,842 at smelters.

	1926		1927	
	Quantity	Value	Quantity	Value
Gold, placer, ounces	20,916	$355,503	9,191	$156,247
Gold, lode, ounces	201,427	4,163,859	178,001	3,679,601
Silver, ounces	10,748,536	6,675,606	10,470,185	5,902,043
Copper, pounds	89,339,768	12,324,421	89,202,871	11,525,011
Lead, pounds	263,023,937	17,757,535	282,996,423	14,874,292
Zinc, pounds	142,876,947	10,586,610	145,225,443	8,996,135
Coal, long tons	2,330,036	11,650,180	2,453,827	12,269,135
Structural stone and miscellaneous minerals	.....	3,675,128	.....	3,326,894
Totals		$67,188,842		$60,729,358

The financial record shows that $10,800,838 was disbursed in dividends by mining companies during the year, but this by no means represents the total net earnings, as all the important companies put back a large proportion of their earnings into development, equipment, exploration of new properties, and the retirement of bonds and debentures, as well as in accumulating a reserve against the possibility of less prosperous times. Net earnings of the Consolidated Mining & Smelting Company of Canada were more than $13,000,000.

An exceedingly satisfactory feature of the year was that all the large companies reported increases in the capacities of their concentration and reduction plants, combined with higher recoveries and lower operating costs. This has made possible the profitable treatment of lower-grade ores. The general outlook for the current year is unquestionably good. The big base-metal producers are all running their plants well ahead of the average daily rate for last year, and a considerable number of medium-sized mines are now contributing toward the mineral production of the province. More exploration and development is under way than at any previous time, and, though some of this work may be ill advised, part of it may make its mark on the production records of future years.

Imports and Exports of Ores and Metals in April, 1927 and 1928

Compiled from U. S. Department of Commerce Records, In Pounds, Unless Otherwise Stated

Imports

	April	
	1927	1928
Antimony		
Ore { Gross weight	1,257,334	385,233
Ore { Antimony content	777,556	211,539
Liquated regulus or metal	3,681,883	2,076,684
Copper		
Ores, copper content	6,582,651	11,068,578
Concentrates, copper content	4,390,546	1,727,810
Regulus, coarse metal, cement copper	55,691	339,500
Imported from:		
Spain	573,306	831,196
Canada	4,555,470	2,695,522
Mexico	2,296,917	3,305,330
Cuba	2,208,000	1,745,500
Chile	1,055,216	4,206,927
Peru	43,769	154,557
Other countries	296,210	196,856
Unrefined black, blister, converter copper in pigs, bars and other forms	32,645,390	46,379,106
Refined copper	14,247,688	3,051,500
Old and clippings for remanufacture	456,589	542,188
Composition metal, copper chief value	11,461	.....
Brass, old, for remanufacture	849,644	326,958
Lead		
Ore and matte, lead content	4,972,942	2,343,655
Bullion or base bullion	21,609,195	18,284,252
Pigs and bars	124,988	782
Babbitt solder and other forms, lead content	184,819	33,960
Type metal, antimonial lead { Gross weight	163,302	111,994
Type metal, antimonial lead { Lead content	94,189	85,787
Manganese, tons		
Cuba, manganese content	158	77
Other countries, manganese content	29,704	14,074
Pyrites, tons	20,204	32,279
Tin		
Ore, tons	10	51
Bars, blocks, pigs	13,950,762	21,267,253
Imported from:		
Netherlands	1,648,817	784,528
United Kingdom	2,474,958	3,987,311
British Malaya	8,917,060	14,122,469
Netherlands East Indies	.....	112,200
Hongkong	224,747	1,351,303
Australia	179,200	100,800
Other countries	505,980	808,642
Zinc		
Ore, zinc content { Free	.....	.....
Ore, zinc content { Dutiable	775,400	212,500
Blocks, pigs, and old	6,895	.....

Exports

	April	
Copper	1927	1928
Ores, composition, concentrates, unrefined	769,899	374,271
Refined copper in ingots and other forms	80,438,599	80,077,621
Exported to:		
Belgium	6,148,478	7,424,841
France	9,866,579	9,720,643
Germany	16,588,451	18,713,728
Italy	5,739,474	5,996,197
Netherlands	8,772,318	5,987,812
Spain	180,433	.....
Sweden	2,293,815	2,799,420
United Kingdom	15,530,958	13,172,634
Other Europe	11,550,326	9,289,568
Canada	1,771,091	1,005,971
British India	441,682	336,016
China, Hongkong, Kwantung	123,200	1,106,149
Japan	927,589	4,403,248
Other countries	504,205	121,394
Old and scrap	4,521,719	4,697,537
Pipes and tubes	220,091	249,626
Plates and sheets	1,339,940	247,742
Rods	6,450,361	4,478,774
Insulated copper wire and cable	1,887,425	1,031,400
Wire	845,814	1,349,422
Lead		
In pigs, bars and other forms	19,406,900	18,958,256
From domestic ore	524,574	48,775
From foreign ore	18,882,326	18,909,481
Exported to:		
France	806,650	1,456,372
Germany	2,912,658	2,251,905
Italy	.....	224,076
Netherlands	.....	448,157
Sweden	224,006	392,420
United Kingdom	3,024,731	5,937,812
Other Europe	4,738,475	1,062,803
Brazil	571,287	224,035
Other South America	1,669,578	190,256
China, Hongkong, Kwantung	952,703	392,378
Japan	4,481,843	6,275,288
Other countries	24,969	102,754
Other lead manufactures	785,448	1,182,603
Zinc		
Ores and concentrates, tons	4,339	.....
Dross	253,255	309,720
Cast in slabs, blocks and pigs	6,617,784	5,239,993
Exported to:		
Belgium	56,000	55,990
France	448,093	1,344,277
Germany	124,450	656,479
Italy	112,060	448,053
Netherlands	8,323	113,933
United Kingdom	112,039	55,987
Other Europe	2,004,641	280,078
Argentina	896,254	.....
Japan	2,464,137	1,411,167
Other countries	391,787	874,029
Sheets, strips other forms	438,132	646,480
Dust	195,884	288,774
Other zinc manufactures	321,303	136,371

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1927	1928	1927	1928	1927	1928
January	55.795	57.135	25.863	26.313	484.775	487.098
February	57.898	57.016	26.854	26.205	484.551	487.008
March	55.506	57.245	25.655	26.329	484.887	487.558
April	56.399	57.395	26.136	26.409	485.178	487.785
May	56.280	60.298	26.072	27.654	485.288	484.685
June	56.769	.....	26.203	.....	485.183	.....
July	56.360	.....	25.983	.....	485.145	.....
August	54.718	.....	25.224	.....	485.546	.....
September	55.445	.....	25.565	.....	485.878	.....
October	56.035	.....	25.776	.....	486.533	.....
November	57.474	.....	26.526	.....	486.956	.....
December	57.957	.....	26.701	.....	487.714	.....
Year	56.370	.....	26.047	.....	485.636	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Spot			
			Standard		Electrolytic	
	1927	1928	1927	1928	1927	1928
January	12.990	13.854	55.414	61.912	62.375	66.575
February	12.682	13.823	54.438	61.670	61.119	66.381
March	13.079	13.845	55.935	61.148	62.641	66.443
April	12.808	13.986	55.056	61.678	61.526	66.500
May	12.621	14.203	54.563	62.554	60.881	67.216
June	12.370	.....	54.030	.....	59.881	.....
July	12.532	.....	54.551	.....	60.089	.....
August	12.971	.....	55.364	.....	62.227	.....
September	12.940	.....	54.455	.....	61.830	.....
October	12.958	.....	55.119	.....	62.256	.....
November	13.319	.....	58.830	.....	63.761	.....
December	13.774	.....	60.078	.....	66.181	.....
Year	12.920	.....	55.653	.....	62.064	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1927	1928	1927	1928	1927 Spot	1927 3 Mos.	1928 Spot	1928 3 Mos.
January	7.577	6.500	7.392	6.280	27.485	27.786	21.773	22.213
February	7.420	6.329	7.286	6.069	27.344	27.781	20.283	20.747
March	7.577	6.000	7.328	5.805	27.845	28.302	19.938	20.352
April	7.126	6.100	6.807	5.991	26.546	27.053	20.306	20.563
May	6.616	6.123	6.269	6.012	25.054	25.526	20.483	20.813
June	6.414	.....	6.150	.....	24.438	24.750	.....	.....
July	6.344	.....	6.120	.....	23.491	23.932	.....	.....
August	6.681	.....	6.367	.....	23.119	23.540	.....	.....
September	6.297	.....	6.044	.....	21.446	21.994	.....	.....
October	6.250	.....	6.013	.....	20.479	20.946	.....	.....
November	6.259	.....	6.035	.....	20.889	21.318	.....	.....
December	6.504	.....	6.319	.....	22.163	22.441	.....	.....
Year	6.755	.....	6.511	.....	24.192	24.614	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York				London	
	1927	1928	1927	1928	1927	1928
	99%		Straits		Spot	
January	64.785	55.180	66.415	55.650	297.804	253.222
February	66.528	51.793	69.142	52.440	306.125	233.833
March	67.833	51.630	69.199	52.220	313.315	232.722
April	66.069	.....	67.933	52.270	302.572	234.204
May	63.935	.....	67.510	51.582	294.938	230.886
June	64.226	.....	67.466	.....	296.006	.....
July	62.625	.....	64.110	.....	288.690	.....
August	63.523	.....	64.431	.....	293.193	.....
September	60.735	.....	61.490	.....	280.432	.....
October	57.560	.....	58.450	.....	264.631	.....
November	57.089	.....	57.641	.....	262.591	.....
December	58.053	.....	58.452	.....	267.138	.....
Year	62.747	.....	64.353	.....	288.953	.....

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1927	1928	1927 Spot	1927 3 Mos.	1928 Spot	1928 3 Mos.
January	6.661	5.643	30.979	30.938	26.125	26.051
February	6.673	5.551	29.931	30.109	25.518	25.506
March	6.692	5.624	30.649	30.889	25.082	24.960
April	6.338	5.759	29.579	29.901	25.493	25.316
May	6.075	6.026	29.034	29.131	26.102	25.756
June	6.213	.....	28.598	28.613	.....	.....
July	6.229	.....	28.280	28.021	.....	.....
August	6.342	.....	28.210	28.068	.....	.....
September	6.212	.....	27.347	27.327	.....	.....
October	5.996	.....	26.899	26.634	.....	.....
November	5.745	.....	26.281	26.006	.....	.....
December	5.722	.....	26.363	26.109	.....	.....
Year	6.242	.....	28.513	28.479	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)			
					Refined		Crude	
	New York		New York		New York			
	1927	1928	1927	1928	1927	1928	1927	1928
Jan.	13.910	10.863	101.200	123.620	109.520	79.280	99.820	69.280
Feb.	14.509	10.842	101.727	121.370	107.545	84.783	99.295	74.783
March	12.801	10.083	110.259	122.557	108.000	80.000	100.426	70.000
April	14.166	9.865	123.250	123.740	101.885	80.000	91.865	70.000
May	12.975	11.019	123.900	123.173	84.680	78.000	75.000	68.000
June	12.447	.....	118.096	.....	72.000	.....	62.500	.....
July	11.880	.....	119.880	.....	72.000	.....	61.520	.....
Aug.	11.826	.....	119.111	.....	72.000	.....	62.000	.....
Sept.	11.073	.....	119.640	.....	72.000	.....	62.000	.....
Oct.	11.165	.....	126.200	.....	72.000	.....	62.000	.....
Nov.	10.763	.....	127.708	.....	72.000	.....	62.000	.....
Dec.	11.195	.....	126.933	.....	72.000	.....	62.000	.....
Year	12.393	.....	118.159	.....	84.636	.....	75.036	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh, and Aluminum 98 Per Cent

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1927	1928	1927	1928	1927	1928	1927	1928
Jan.	19.50	17.50	18.16	17.00	18.50	17.25	26.270	24.300
Feb.	19.02	17.50	18.00	17.00	18.50	17.25	26.000	24.300
March	19.37	17.50	18.28	17.00	18.50	17.25	26.000	24.300
April	19.50	17.50	19.00	17.00	18.50	17.24	26.000	24.300
May	19.24	17.37	18.24	16.38	18.50	.....	26.000	24.300
June	18.96	.....	17.96	.....	18.35	.....	26.000	.....
July	18.50	.....	17.50	.....	18.00	.....	26.000	.....
Aug.	18.50	.....	17.32	.....	17.65	.....	26.000	.....
Sept.	18.00	.....	17.11	.....	17.50	.....	26.000	.....
Oct.	18.00	.....	17.00	.....	17.50	.....	25.600	.....
Nov.	18.00	.....	17.00	.....	17.47	.....	25.000	.....
Dec.	17.69	.....	17.00	.....	17.25	.....	24.785	.....
Year	18.69	.....	17.71	.....	18.02	.....	25.808	.....

Iron in dollars per long ton. Aluminum in cents per pound, 98 per cent grade.

New figures, pig iron f.o.b. Mahoning and Shenango valley furnaces, instead of delivered Pittsburgh. Difference from former figures, which were delivered Pittsburgh, $1.76, this being the freight.

Monthly Crude Copper Output in Short Tons

	1927		1928		
	Nov.	Dec.	Jan.	Feb.	Mar.	April
Domestic						
Alaska shipments	1,402	1,655	2,084	908	3,495	.....
Butte & Superior	.....	†238	.....	.....	†205	.....
Calumet & Arizona	2,018	2,065	2,066	2,041	2,019	2,102
Magma	1,404	652	1,300	1,398	1,346	1,525
Miami	2,099	2,032	1,963	1,955	2,029	2,092
New Cornelia	3,613	3,607	3,672	3,267	3,318	3,224
Nevada Con.	.....	†26,253	.....	.....	†26,288	.....
Old Dominion	832	801	*996	*992	*1,009	*988
Phelps Dodge††	7,799	7,757	8,273	7,331	7,803	8,334
United Verde Extension	1,698	1,930	1,633	1,624	1,699	1,604
Utah Copper	.....	†27,810	.....	.....	†27,810	.....
Tennessee Copper	594	617	510	514	596	526
Foreign						
Braden	9,354	9,348	8,502	8,504	8,504	.....
Boleo, Mexico	990	1,001	1,068	1,262	1,130	1,012
Bwana M'Kubwa	447	554	677	600	533	392
Chile	8,960	8,972	8,146	8,119	7,854	.....
Furukawa, Japan	1,649	1,563	1,548	1,563	.....	.....
Granby Cons., Canada	2,208	1,936	2,305	2,155	2,326	2,406
Mount Lyell, Australia	.....	†2,064	.....	.....	†1,510	.....
Sumitomo, Japan	1,317	1,412	1,317	1,381	1,316	1,483
Union Miniere, Africa	10,890	10,803	10,390	9,590	10,864	.....

†Three months. *Includes Arizona Commercial
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1926		1927		1928	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	71,026	2,291	76,198	2,458	68,469	2,209
February	68,131	2,433	69,202	2,472	67,423	2,325
March	75,728	2,443	69,314	2,236	70,327	2,269
April	73,454	2,448	71,122	2,371	69,230	2,308
May	73,542	2,372	71,613	2,310	.....	.....
June	71,317	2,377	69,539	2,318	.....	.....
July	72,228	2,330	65,545	2,114	.....	.....
August	72,014	2,323	67,248	2,169	.....	.....
September	72,672	2,421	65,936	2,198	.....	.....
October	75,099	2,423	68,595	2,225	.....	.....
November	74,947	2,498	68,080	2,269	.....	.....
December	72,205	2,329	67,377	2,173	.....	.....
Total	872,509	.....	829,878	.....	275,449	.....
Monthly average	72,709	.....	69,165	.....	68,862	.....
Average of daily rate	.....	2,390	.....	2,274	.....	2,276

statistics released today are decidedly favorable to the producers, and an advance in London lead quotations is prophesied by several local authorities as a result. Cable manufacturers have been a dominating factor in the market this week. Sales of antimonial lead have been exceptionally good. Corroding grades of lead command the usual premium of $2 to $3 a ton.

Zinc Prices Still Nominal

In zinc, the buyers' strike and the sellers' lock-out continues. Prices of 6⅛ to 6.15c., St. Louis, are largely nominal, and a little metal has been sold at the extreme ranges of 6.10 and 6.20c. With at least three weeks of very small business, sellers must certainly be accumulating zinc, but there seems to have been no break in their ranks so far, and they feel that they can get their price by waiting. Thus far the galvanizers and other zinc-consuming interests have been content to follow the same tactics.

Tin Easy at Lower Prices

The tin market for the week is characterized by a small volume of business and a gradual lowering of prices. Consumers remain uninterested in spite of the decline, although it is not unlikely that stocks at consumers' plants are very low. Tin for forward delivery now commands a premium of about ¼c. per pound.

Silver Lower

The silver market declined sharply during the early part of the last week and has since remained steady at the lower levels. Reports from abroad state that China has both bought and sold, and moderate buying orders from that quarter have been received in the local market. The tendency remains uncertain.

Mexican Dollars (Old Mexican pesos): May 31st, 46⅜c.; June 1st, 47⅝c.; 2d, 46⅛c.; 4th, 5th, and 6th, 46⅜c.

Exchanges Slightly Lower

The principal European exchanges are slightly lower than a week ago. Closing cable quotations on Tuesday, June 5, were as follows: Francs, 3.93⅞c.; lire, 5.26¾c.; and marks, 23.885c. Canadian dollars, $\frac{3}{32}$ per cent discount.

Joplin Lead Ore Again Advanced

Joplin, Mo., June 2, 1928

Blende	Per Ton
High	$43.35
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent zinc	36.00@ 39.00
Average settling price, all zinc	39.16
Galena	
High	$82.60
Basis 80 per cent lead	82.50
Average settling price, all lead	80.23

Shipments for the week: Blende, 14,675; lead, 1,403 tons. Value, all ores the week, $687,360.

A second advance of $2.50 per ton for lead concentrates has loosened the strings sellers had drawn tightly over reserves, and a large tonnage is reported sold, which should appear in next week's shipment report. Prices for blende were unchanged and a larger tonnage was disposed of on account of the advance in lead equalizing the cost of production. The total purchase was 13,300 tons, with 1,400 tons from reserve stock.

Platteville, Wis., June 2, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent lead	$78.50

Shipments for the week: Blende, 592 tons; lead, 40 tons. Shipments for the year: Blende, 15,945 tons; lead, 960 tons. Shipments for the week to separating plants, 782 tons blende.

Steel Production High—Pig Iron Prices Lower

Pittsburgh, June 5, 1928.

Steel buying, in individual orders and contract specifications, began to decrease in April, and has since decreased further. Production was slightly heavier in April than in March, when for four preceding years March had been the high month of the year. Ingot production averaged 89 per cent of capacity in March and April and was at about 80 per cent at the beginning of June. Following the later peak demand, the recession is now more gradual. Steel production in the half year promises to show about 3 per cent gain over the first half of last year and 2 per cent gain over the first half of 1926, which was the record high for any half year. Compared with either half year there have been losses in oil- and gas-field consumption of tubular goods and in locomotive and freight-car building. Automobile production has been slightly heavier this year than last, but the official report for the first four months shows 12 per cent decrease from the same months of 1926. Consumption of steel by the agricultural-implement industry has increased to a record high rate. Fabricated structural steel construction so far this year has been ahead of other years, but lettings have been so light since April 1 that the lead may soon be lost. Various minor lines must have increased their steel consumption to account for the production.

Finished steel prices showed no material change during May except for slight further weakening in sheets and strips. Bars, shapes, and plates remain at 1.85c., Pittsburgh, in the open market, with mills soliciting third-quarter contracts at 1.90c., evidently expecting to advance the asking price to 1.95c. early in July.

Pig Iron—Valley pig iron has declined $1 on basic to $16, 50c. on bessemer to $17, and 25c. on foundry to $17, f.o.b. Valley furnaces. The Chicago market declined 50c. Southern iron was marked down 50c. and then marked back to $16, Birmingham.

Connellsville Coke—The market has remained very dull, with heating coke at $2.25@$2.75 and foundry at $3.75@$4.25. Furnace coke stiffened a trifle, to a range of $2.65@$2.75.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, 10½c., for all positions. Market quiet. Cookson's "C" grade, spot, 15⅜c.

Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $2.10. Smaller lots $2.25 and up. London 9s.

CADMIUM—Per lb., 65c. Active demand. London, 2s.@2s. 1d. for Australian metal.

COBALT—Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $275@$300 for 98 @99 per cent sponge and powder. Market inactive.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x16 in.), 98c.; 3-lb. sticks (1⅛x33 in.), $0.95@$1; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market active. London 4s.@4s. 3d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per gram, 99 per cent, 4c. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.90 per cent grade), for single lots of spot metal. London, per long ton, £170@£175 according to quantity. Market fairly active.

OSMIUM—Per oz., $65@$80; London, £15@£18.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. London £10¼@£11½. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75.50@$76.50 asked. Market quiet.

London, per oz., £17@£17 2s. 9d. for refined; crude and scrap, nominal at £15 10s.@£16.

QUICKSILVER — Per 76-lb. flask, $123. Market easy. San Francisco wires $125. London firm at £22¼@£22½.

RADIUM — Per mg. radium content, $70.

[1]Price furnished by Foote Mineral Co., Philadelphia.

The Market Report

Copper and Lead Active at Unchanged Prices

Tin Drops Below 50c., and Silver Reacts to 60⅜c. in Quiet Market

New York, June 6, 1928.—The week ending today has been characterized by better than average volume of sales of lead and copper, with substantially the same prices as obtained a week ago. Zinc continues dormant, also with practically no change in price. Both tin and silver are lower, prompt Straits tin having been continuously below 50c. for the first time in four years. The reaction in silver to close to 60c. is perhaps only natural after the recent rapid rise.

Daily Prices of Metals

May / June	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
31	14.525	49.875	6.30	6.175@6.20	6.125@6.15
1	14.525	49.75	6.30	6.15@6.20	6.125@6.15
2	14.525	49.625	6.30	6.15	6.125@6.15
4	14.525	49.50	6.30	6.15@6.20	6.125@6.15
5	14.525	49.25	6.30	6.15	6.10@6.15
6	14.525	49.50	6.30	6.15	6.125@6.15
	14.525	49.583	6.300	6.165	6.135

Average prices for calendar week ending June 2, 1928, are: Copper, 14.528; Straits tin, 50.275; N. Y. lead, 6.280; St. Louis lead, 6.143; zinc, 6.133; and silver, 61.275.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

May / June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
31	64	64	68½	227¾	227¼	21 5/16	21 9/16	26	25¾
1	63⅞	63⅞	68½	226⅝	226½	21 7/16	21 11/16	25¾	25 11/16
4	64	64 1/16	68¾	223⅞	223⅝	21 9/16	21 13/16	25⅞	25 11/16
5	64 1/16	64⅛	68¾	223¾	223½	21 7/16	21⅝	25⅞	25 11/16
6	64⅛	64⅛	68¾	223⅛	222¼	21⅝	21 9/16	25⅞	25⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May / June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
31	4.87¾	60⅞	27 11/16	84s11d	4	4.87 13/16	60¼	27¾	84s11d
1	4.87 13/16	61¾	28 1/16	84s11d	5	4.87⅝	60¼	27⅝	84s10¼d
2	4.87 13/16	60¼	27 15/16	.....	6	4.87¾	60⅜	27 13/16	84s10½d

Avg. 60.625

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cents premium.

Average Metal Prices for May, 1928

COPPER:	
New York Electrolytic	14.203
London Standard Spot	62.554
London Electrolytic Spot	67.216
LEAD:	
New York	6.123
St. Louis	6.012
London Spot	20.483
London Forward	20.813
SILVER:	
New York	60.298
London	27.654
Sterling Exchange	487.685
ZINC:	
St. Louis	6.026
London Spot	26.102
London Forward	25.756
TIN:	
Straits	51.582
London	230.886
QUICKSILVER	123.173
ANTIMONY	11.019
PLATINUM:	
Refined	78.000
Crude	68.000
ALUMINUM, 99 PER CENT PLUS	24.300

Copper Demand Continues

Though it is the general impression among copper sellers that the week has been a quiet one, nevertheless the total sales have been somewhat above the average weekly business for the first five months of the year. Early deliveries have been particularly in demand, but several sellers have been unwilling to quote on anything this side of August. Others, however, have been able to find a little June and July copper available on their books, so that the tonnage sold for each of the months of June and July has been somewhat greater than that booked for August. Little interest is yet taken in September.

Prices are uniformly 14¾c. delivered at Connecticut points. Middle Western sales have brought the customary ⅛@¼c. premium, depending on delivery points, but sales in that territory have been a very small proportion of the total. Consumers report continued activity at their plants, the recent advance in price having stimulated orders.

The export demand has been excellent so far this month, with an average of over 2,000 long tons sold per calendar day by the export association. The price is unchanged at 15c., c.i.f.

Fair Activity in Lead

Sales of lead have been in better than average volume during the week ending today. The price is steady at 6.30c. per pound in New York, the level of the American Smelting & Refining Company's contract price. In St. Louis, the market is slightly lower than a week ago, but a widening of the differential between New York and St. Louis prices was to be expected sooner or later. Most of the sales in the Mid-West have been at the 6.15c. level, but a number have been made at 6.175c. and one or two lots of chemical lead for July delivery have brought 6.20c. per pound. May

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.75@$3; ground, $4@$9; agricultural, $6@$10; calcined, $7@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c. Good demand.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 50c.@$2.

Agricultural, $1 up to $4 or $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $42; Grade B, $37.50; dead burned, $28, crude, $11. F.o.b. Eastern seaboard, calcined, $40. Market slow. Magnesite from the Far East is reported in the domestic market.

MICA—Per ton, f. o.b. plant:

New Hampshire: Mine run, $320; clean shop scrap, $25; mine scrap, $22.40. White dry ground, 20 mesh, $25; 40 mesh, $40; 60 mesh, $65; 100 mesh, $75; 200 mesh, $85.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: No. A1, $3.50@$4; No. 1, $3; No. 2, $2.50; No. 3, $1.30; No. 4, 70@80c.; No. 5, 45c.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market good.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent, $4. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6; 74@75 per cent, $5; 72 per cent, $4; 70 per cent, $3.50. Market firm.

Tennessee, ground, 97 per cent through 200 mesh, 33 per cent P_2O_5, $9.50 per ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices are as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent....	36.40	34.80
Sulphate of potash 90 @ 95 per cent, basis 90 per cent....	47.30	45.70
Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent	27.25	25.65
Manure salt 30 per cent.....	21.75	18.75
Manure salt 20 per cent.....	15.40	12.40
Kainit 14 @ 16 per cent.....	12.50	9.50
Kainit 12.4 per cent.....	12.00	9.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur, Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ½ to ½ lb. in weight, 40c. For optical purposes, double above prices; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market improving. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35 @$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per ton for domestic market, $18, f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $9.50@$10; 96½ to 98 per cent through 200 mesh, medium white, $8.50@$9.50; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks. Market weak.

New York: Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

Georgia: Powdered, gray, $7.50@ $10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

New Jersey: Soapstone, ground, $10 @$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream, $25; mill run, $15. Demand slow during summer months.

Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent Sb_2O_3, 15½c. per lb. Several hundred tons sold.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c. Delivered near by. Quiet. London, per long ton, £17@£17½ quoted for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c.@$1, delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5.30@5.40c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude, in bags ex vessel, Atlantic ports, $2.30 @$2.32½ for spot; future delivery, $2.17½@$2.25.

[1]Price furnished by Foote Mineral Co., Philadelphia.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $10@$17.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

Alloys

[1]FERROCERIUM—Per lb., $9 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Spot shipments slightly higher. Freight allowed in carload lots east of Mississippi River.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105 for last half of 1928. Spiegeleisen, 19@21 per cent, $32 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.25.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee.*

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 14@17 per cent, $45. Quotations for spot shipments slightly higher. Market fairly active.

FERROTITANIUM—Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 95@98c., f.o.b. works. Market strong at higher prices.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, $3.15@$3.65, depending on grade and quantity. Market active.

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL SILVER—29¾c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 20¼c. per lb.; rods, 17¼c. per lb.

Rolled Metals

COPPER—Sheets, 23½c.; wire, 16⅝c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

ZINC SHEETS — 9c. per lb., f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35 @$38.

MAGNESITE BRICK—Per net ton, f.o.b. works: 9-in. straights, $65.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio,* $43; *Alabama,* $51; *Illinois,* $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent ZrO_2, 3½c. Brick, straights, 80c.@ $1 each.

RHODIUM—Per oz., $55@$60. Nominal.

RUTHENIUM — Per oz., $45@$60. Nominal.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 12c. Nominal.

TELLURIUM—Per oz., 15@18c.

[1]THALLIUM METAL—Per oz.: Ingot, 99 per cent pure, $1.06 in 25-lb. lots.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1@$1.20, depending on quantity. Market largely nominal.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

Metallic Ores

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22@$23.50 for 45 to 50 per cent Cr_2O_3 ore. Prices firm.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 58 to 63 per cent, 8@8½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 11 @11½c., nominal.

Spanish foundry or basic, 50@54 per cent, 8½@9c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@9½c.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, Brazilian and Indian ores, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@40c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of combined Ta_2O_5 and Cb_2O_5, basis 65 per cent ore, $30.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $11@$11.15, Western scheelite, $10.60@$10.75. Market active at higher prices.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $8 in 30-ton lots.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $600@$650; crude No. 2, $375@$400; spinning fibers, $190@$225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $15. Market firm, demand good.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $7. Washed and water floated to 97 per cent through 300 mesh, $19. Market fair, but showing effect of continued foreign competition.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $6.50, f.o.b. mines. Market fair.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8, f.o.b. *Georgia* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $7.50@$8.50 f.o.b. *Georgia-Alabama* mines. Pulverized and dried, $14; calcined, 78 to 84 per cent Al_2O_3, $18@$20.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.80@$6.50; Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 5 per cent SiO_2, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 4c.; granulated or powdered, 3¾c.; f.o.b. plant, Pennsylvania.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York*, $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$15; ground, $7@$10.

Florida, pressed pottery, bulk, $13.50; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour, No. 1, $20; No. 2, $17. Market slow.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $45@$50.

DIATOMITE — Per short ton, f.o.b. plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45. Over 85 per cent silica, 98 per cent through 200 mesh, $25@$26, depending on quantity.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $5.50@$7.50; glass grades, $5@$6. Market dull.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $9.

New York, Per ton: f.o.b. cars, No. 1 crude, $9. Market very quiet.

Tennessee, per ton: No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 140 mesh, $13.75; 200 mesh, $15.50; market slow.

Maine, per ton: Best pottery grade, ground, $19. Market fair.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines.

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $16. Foundry lump, 85-5, $18. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market very quiet.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 97-2 sacked, $30. Market fair.

Foreign spar, duty paid, $15.50@$16, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh up, $8; 200 mesh up, $14.

Powdered, import duty paid, $24@$25 per ton.

GARNET — Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50.

GRAPHITE—Per lb.: F.o.b. *New York*.

Ceylon lump, 8@8½c.; chip, 7@7½c.; dust, 3@5½c.; Madagascar flake, 7¼@8½c. Market fair.

No. 1 flake, 10c. and up. No. 2 flake, 7c. and up. Foundry facings, 3c. and up. Amorphous and crystalline, fine ground, 3c. and up.

Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $25.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Mining Stocks—Week Ended June 2, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	74	69⅛	74	Ap.14, My.21 Q	0.75
Ariz. Com'l	Boston	5⅛	4⅝	4⅝	Ja. 19, Ja. 31 SA	0.25
Cal. & Ariz	New York	108⅜	102½	105⅝	Jn. 8, Jn. 25 Q	1.50
Calumet & Hecla	Boston	25⅜	24½	24⅝	My. 31, Jn. 15 Q	0.50
Cerro de Pasco	New York	76¼	71½	76⅛	Ap.12, My.1 Q	1.00
Chile Copper	New York	45⅛	43	44⅜	Jn.6, Jn.30 Q	0.62½
Con. Coppermines	N. Y. Curb	14⅜	13	13⅛	...	...
Copper Range	Boston	22	20⅜	21⅜	Ma. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*67	*60	*65	...	...
East Butte	Boston	3	2⅜	2⅜	Dec., 1919	0.50
Granby Consol	New York	56⅜	54⅛	56⅛	Ap.13, My.1 Q	1.00
Greene Cananea	New York	127	120	125⅜	Jn. 15, Ju. 2	1.00
Howe Sound	New York	62⅜	58½	61⅛	Ma.31, Ap.16, Q	1.00
Inspiration Consol	New York	25¼	24⅛	25⅛	Apr. 1927 Q	0.25
Isle Royale	Boston	22	19½	21	Fe.28, Ma.15 SA	0.50
Kennecott	New York	95⅜	92⅜	94⅛	Jn. 1, Ju. 2 Q	1.25
Magma Copper	New York	56⅛	53⅜	56	Ma.31, Ap.16 Q	0.75
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅜	...	...
Miami Copper	New York	22	21⅛	21⅜	My.1, My.15, Q	0.37½
Mohawk	Boston	64⅜	62⅛	63	Ap. 30, Jn. 1 Q	1.00
Montana-Idaho	Spokane	*28⅛	*26⅛	*28⅛	...	...
Mother Lode Coal	New York	3⅜	3⅛	3⅛	Ju. 8, Ju. 30	0.15
Nevada Consol	New York	25⅛	24⅛	25	Ma.16, Ma.31 Q	0.375
New Cornelia	Boston	30	29⅜	29⅜	My. 4, My. 21 Q	0.50
Noranda	N. Y. Curb	31⅜	25	29⅜	...	...
North Butte	Boston	2	1 1/16	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*89	*85	*85	Sept., 1926	0.03
Old Dominion	Boston	15⅜	14	14	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	138	134½	137	Ma.20, Ap.2 Q	1.50
Quincy	Boston	40½	37½	37½	March, 1920	1.00
St. Mary's Min. Ld	Boston	34	30	30	Ap.1928 A	2.00
Seneca Copper	New York	4⅛	3⅛	3⅛	...	...
Shattuck-Denn	N. Y. Curb	20⅞	18⅞	19⅜	...	...
Tenn. C. & C	New York	16⅜	14⅜	15⅛	Ma.29, Ju.15,Q	0.12½
United Verde Ex	N. Y. Curb	23⅜	19⅜	19⅜	Ap.6, My.1, Q	0.50
Utah Copper	New York	158	158	158	Ma.16, Ma.31 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.20	1.07½	1.20	...	...
NICKEL-COPPER						
Internat. Nickel	New York	103	91	101⅛	Ma.15, Ma.31Q	0.50
Internat. Nickel pfd	New York	115	114½	114½	Ap.12, My.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*4¼	*3	*3⅜	June, 1927	0.005
National Lead	New York	126½	126	126	Jn.15, Jn.30 Q	1.25
National Lead, pfd. A	New York	147¼	146½	146½	Ju.1, Ju.15 Q	1.75
National Lead, pfd. B	New York	120½	120½	120½	Jy. 20, Au. 1 Q	1.50
St. Joseph Lead	New York	47½	44	47	Jn.9, Jn.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	30⅜	27⅜	28⅜	May, 1917	1.00
Am. Z. L. & S. pfd	New York	91½	88	89⅜	Nov., 1920	1.50
Butte C. & Z	New York	10	9	9⅛	De., 1926	0.50
Butte & Superior	New York	16⅜	14⅛	15⅜	Ma.14, Ma.31 Q	0.50
Callahan Zn-Ld	New York	4⅜	3⅞	4	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	16	16	16	Ap., 1927	0.25
Eagle-Picher	Cincinnati	20	18⅜	19⅜	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	102	102	102	Ma. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	225	216	225⅞	Jn. 20, Ju. 10 †	2.00
Treadwell-Yukon	Toronto	23.50	16.95	.0.00	...	...
United Zinc	N. Y. Curb	.00	*90	*99	...	...
Yellow Pine	Los Angeles	*35	*25	*35	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4	3⅜	3⅜	...	...
Ankerite	Toronto	*45	*40	*41½	...	...
Barry-Hollinger	Toronto	*88	*76	*82	...	...
Central Manitoba	Toronto	1.63	1.27	1.33	...	...
Cresson Consol. G	N. Y. Curb	1⅜	1 1/16	1⅜	Ma.31, Ap.10 Q	0.10
Dome Mines	New York	9⅜	9¼	9⅜	Ma.31, Ap.20 Q	0.25
Golden Cycle	Colo.Springs†	1.72	†1.68	...	My. 31, Jn.10 Q	0.04
Gold Hill	Toronto	*12	*10½	*11½	...	...
Hollinger Consol	Toronto	15¼	13½	13⅜	My.30, Ju.16 FW	0.10
Homestake Mining	New York	73	73	73	My.19, My.25 M	0.50
Kirkland Lake	Toronto	1.89	1.81	1.85	...	...
Lake Shore	Toronto	23.60	22.80	23.05	Jn.1, Jn.15	0.20
McIntyre Porcupine	New York	27⅜	27	27⅜	May1, Ju.1 Q	0.25
Portland	Colo.Springs	†*13½	†*10	...	Ap., 1927	0.02
Rand Mines	New York	...	...	43	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	3.15	3.05	3.10	...	...
Teck-Hughes	Toronto	10.30	9.75	10.10	Ja. 17, Fe. 1 X	0.15
Tom Reed	Los Angeles	*42½	*40	*41½	Dec., 1926	0.02
Tough-Oakes	Toronto	*27	*23	*26½	...	...
Vipond Cons	Toronto	*59	*56½	*58½	April, 1927	0.03
Wright-Hargreaves	Toronto	4.65	4.05	4.20	Ap.13, My.1 Q	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	24⅜	23⅛	23⅛	...	...
Con. Cortez	N. Y. Curb	*29	*28	*29	...	...
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	16⅛	16⅛	16⅛	Ap.18, Ap.28 Q	0.50
Premier Gold	N. Y. Curb	2 3/16	2⅛	2⅛	Ma.15, Ap.4	0.08
Tonopah Belmont	N. Y. Curb	1 1/16	1 1/16	1 1/16	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*15	*14	*14	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4 1/16	4	4	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb	*7	*7	*7	Mar., 1923	0.05
Yukon Gold	Boston Curb	*65	*63	*64	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.40	1.30	1.35	May, 1920	0.03
Castle-Trethewey	Toronto	*72	*61	*63	...	...
Coniagas	Toronto	5.00	5.00	5.00	May, 1924	0.12½
Keeley	Toronto	*73	*70	*70	Ma.1, Ma.15 SA	0.04
Lorrain Trout Lake	Toronto	*70	*50	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.55	3.30	3.50	My.20, Jn.13 SA	0.125
Nipissing	N. Y. Curb	4⅛	4⅛	4⅜	Ma.31, Ap.20Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	4⅛	4⅛	4⅛	Ap., 1927	0.12½
Bingham Mines	Boston	49¼	47⅛	47⅛	Ma.22, Ap.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	...	...	130¼	Ap.30, My.4 MX	0.75
Cardiff M. & M	Salt Lake	5.74	5.74	5.74	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.25	4.20	4.23	Ja.10, Fe.1 K	0.10
Consti'nMng.&Mill'g.	Spokane	*14	*9	*14	...	...
Erupcion	Boston Curb	...	...	*30	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	3.37½	2.32½	2.35	...	...
Federal M. & S	New York	...	...	130	Je., 1927	10.00
Federal M. & S. pfd	New York	98	97⅜	98	My.25, Jn.15 Q	1.75
Hecla Mining	N. Y. Curb	15⅜	15	15⅜	My.15, Jn.15 Q	0.15
Highland-Surprise	Spokane	*13½	*12	*13½	...	...
Iron King Mining	Salt Lake	*76	*69	*76	...	...
Keystone Mining	Salt Lake	†*33	†*25	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*34	*30	*32	...	...
Lucky Tiger-Com	Kansas City	†8.15	†7.85	...	My.10, My.19 MX	0.07
Mammoth Mining	Salt Lake	†1.85	†1.45	...	De., 1926	0.25
North Lily	Salt Lake	8.20	7.75	8.20	...	...
Park Utah	Salt Lake	14½	13½	14¼	Jn.15, Ju.2 Q	0.20
Plutus Mining	Salt Lake	2.00	1.90	1.90	Ap.10, Ap. 16 Q	0.10
Silver King Coal	Salt Lake	12¼	12¼	12¼	Ma.20, Ap.2 Q	0.25
Silversmith	Spokane	*21	*16	*16½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*63	*50	*61	...	...
Sunshine M. Co	Spokane	1.50	1.42	1.50	Fe.10, Fe.20	0.10
Tamarack-Custer	Spokane	*75	*67	*70½	Sept., 1924	0.25
Tintic Standard	Salt Lake	15	13⅞	15	Jn. 18, Jn. 30Q	0.36
Utah-Apex	Boston	4⅜	4⅛	4⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	64⅜	60⅜	62⅛	Jy., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	119	115	116	Ap.13, Ap. 25. Q	1.00
Colorado Fuel & Iron	New York	77⅛	73⅛	76⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	22½	21⅛	22⅛	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	60	57	58	My. 15, Jn.1 Q	0.62½
Republic I. & S	New York	61⅜	58	60	My.15, Jn.1 Q	1.00
Republic I. & S. pfd	New York	107	107	107	Jn. 15, Jy. 2 Q	1.75
Sloss-Sheffield S. & I	New York	118	116	118	Jn.9, Jn.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	...	...	115⅜	Jn. 20, Jn. 2 Q	1.75
U. S. Steel	New York	147⅜	142⅜	145½	My.31, Jn.29 Q	1.75
U. S. Steel, pfd	New York	143	142½	142⅜	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C	New York	...	...	50	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	58	58	58	Jn. 16, Ju. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	27	Jy., 1927	1.45
So. Am. G. & P. New	N. Y. Curb	3⅛	3⅛	3⅛	...	...
Alum. Co. of Amer	N. Y. Curb	197	180⅛	188	...	...
Alum. Co. of Amer. pf.	N. Y. Curb	109⅜	109¾	109¾	Ma. 15, Ap. 1 Q	1.50
Vanadium Corp	New York	86⅜	80⅛	84⅛	My. 1, My. 15 Q	0.75
Patino M. & E	New York	38	35	35	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	35	32	33⅜	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	94	92	92	Ma. 31, Ap. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	73	63⅛	65⅛	Ap.14, Ma.1 QX	1.75
Texas Gulf	New York	72⅛	69⅛	70⅛	Ju.1, Ju.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48⅛	46⅜	48⅛	My.15, Jn.1	0.75
Amer. Metal, pfd. 6%	New York	114⅛	114⅛	114⅛	My.15, Jn.1	1.50
Amer. Met. pfd. 7%.	New York	125	125	125	My.15, Jn.1	1.75
Amer. Sm. & Ref	New York	201⅛	190⅛	201⅛	Ap.13, My.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	135⅛	135	135⅛	My. 4, Jn. 1 Q	1.75
Consol. M. & S	Montreal	272	265	272	Ja. 16, SAX	6.25
Newmont Mining	N. Y. Curb	184⅛	169⅛	184⅛	Ma.31, Ap.16 Q	1.00
U. S. Sm. R. & M	New York	50	47	50	Ap.5, Ap.14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54⅛	54⅛	54⅛	Ap.5, Ap.14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED May 22, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	37/6	37/—	37/—	...	...	...
Alaska Treadwell ($25)	147/6	144/6	145/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	68/9	65/—	67/6	May, 1928	5	p.c. (†)
Burma Corpn. (10 rupees)	14/4½	13/9-	14/—	Jan., 1928	6 annas*	
Bwana M'Kubwa (5s)	4/10½	4/6	4/6	...	...	
Camp Bird (2s)	5/—	4/6	4/9	April, 1928	16⅜	p.c.
El Oro (£1)	4/10½	4/6	4/6	Nov., 1924	2½	p.c.*
Frontino & Bolivia (£1)	14/6	13/9	13/9	Jan., 1928	5	p.c.
Mexican Corpn.(£1)	11/9	11/—	11/9	...	...	
Mexico Mines of El Oro (£1)	42/6	40/7½	42/6	Dec., 1926	3¾	p.c.*
Mond Nickel	183 1/4	166 7½	172/6	Feb., 1928	7½	p.c.
N'Changa Copper Mining	10/3	9/3½	10/3	...	...	
Oroville Dredging (£1)	4/3	4/—	4/—	Dec., 1923	3¾	p.c.
Rhodesian Congo Border (£1)	21/10½	18/9	21/10½	...	...	
St. John del Rey (£1)	11/3	10/7½	11/3	April, 1928	7½	p.c.
San Francisco Mines (10s)	30 —	28/4½	29/—	Jan., 1928	25s.	
Santa Gertrudis (£1)	17/—	15/6	16/9	Jan., 1928	7½	p.c.
Selukwe (2s. 6d.)	14/6	11/10½	13/1½	April, 1917	6¾	p.c.
S. Amer. Copper (2s.)	3/4½	2/10½	3/1½	Nov., 1917	7½	p.c.
Tanganyika (£1)	67/—	60/7½	62/5	Aug., 1927	7½	p.c.
Union Miniere de Haut-Katanga (Brussels)	8,650	8,600	8,650	July, 1927	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.